WARD, LOCK & CO.'S

PHOTOGRAPHY

PICTURE-MAKING SIMPLIFIED

BY

PERCY R. SALMON, F.R.P.S.

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The
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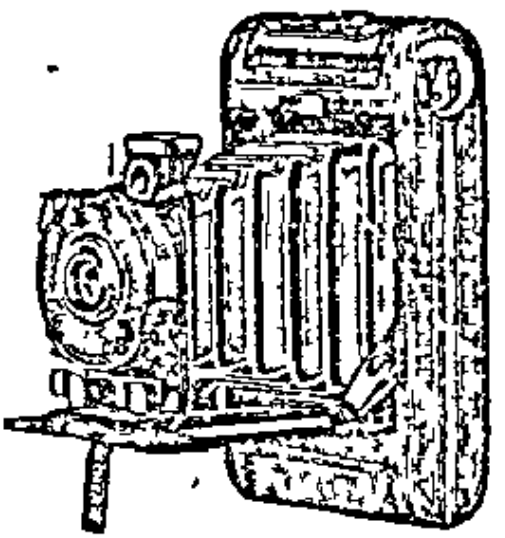

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CHAPTER I

CHOOSING A CAMERA

THE task of selecting a camera is not an easy one. Every year witnesses the introduction of many new patterns.

Types of Cameras

The following are the types in most general use:

Roll-film Cameras (Box form).
Roll-film Cameras (Folding).
Film-pack Cameras.
Plate Cameras (Box form).
Plate Cameras (Folding).
Focal-plane Cameras.
Reflex Cameras.
Field or Stand Cameras.

It is impossible to describe all the many different makes of cameras now on the market; all we can do is to give brief details of the different types, and having settled upon a type, the reader can decide which pattern he will purchase, as perhaps half a dozen or more firms are making cameras of the type favoured, all alike in the main, but varying in constructional details and price.

Price is very often the first consideration, and in this cameras vary widely. Small and most serviceable cameras are obtainable at about 10*s.*, while one may spend as much as £50 on a better instrument.

Cameras for Roll Films

The simplest of the roll-film cameras is the box form, which really consists of two boxes, one sliding within the other. The film spool is fixed at the bottom of the front of the inner box (which is withdrawn for the purpose) and the end of the paper protecting the film is threaded round the back, and finally wound upon the receiving spool, fixed at the top of the front, the winding key of which is on the outside of the camera. This type of camera takes pictures ranging from about 2½ × 1½ inches to about 4 × 3 inches.

These instruments are usually of "fixed focus" and will photograph clearly objects at and beyond a certain distance from the camera but nothing nearer The cheap cameras are very efficient so long as their limitations are understood

Folding cameras for films are very popular—there are more of this type on the market than of any other Some of the smaller sizes are similar to the box models in that they have no arrangement for focussing the bellows pulling to a point at which the lens acts on the fixed focus principle In others the bellows may be pulled out to varying extents, in order to focus on objects at various stated distances from the lens With roll film cameras this is the only method of focussing available though where a separate back is provided for plates a focussing screen can, of course, be used.

Prices of folding cameras of this type range from about 25s to about £30, the quality of the lens influencing the price. The great advantage of these cameras is their portability, they may be loaded and unloaded in daylight

Film-Pack Cameras

Film pack cameras are made specially for flat films in the form of a film pack. Film packs can be used with any hand camera used for plates in dark slides, and many users of the film pack prefer to have a camera which will take either plates or flat films rather than a film pack camera, which will take only films. The film pack camera is in shape practically the same as the folding camera for plates

Cameras for Plates

We now come to cameras made specially for dry plates,

The cheapest form of plate camera is the magazine or box form taking six or twelve plates The plates are held in sheaths at the back of the camera ready for exposure After each exposure the movement of a lever allows the exposed plate to fall to the bottom of the camera, and another plate is automatically brought into position for exposure

This type of camera is rather bulky and the size is usually limited to quarter plate The cheapest patterns are "fixed-focus". slightly higher priced models are fitted with supple-

mentary lenses or "magnifiers," which allow objects as near as 3, 6 or 9 feet to be focussed, while the more expensive patterns have arrangements for moving the lens and focussing by scale

Folding plate cameras are immensely popular, they are most compact and efficient, and have a focussing movement. Most of them have a ground glass screen for focussing when the camera is used upon a tripod, in addition to a scale for use when the camera is employed in the hand Dark slides are used to hold the dry plates or cut films The many patterns of this type are far too numerous for detailed descriptions of them to be given, and the prices vary enormously The favourite size of this camera is the $4\frac{1}{4} \times 3\frac{1}{4}$ inches, though the $3\frac{1}{2} \times 2\frac{1}{2}$ inches has many admirers

The Focal-Plane Camera

The focal plane camera is a special type of instrument used largely by Press photographers and others who wish to do the most rapid work. It takes its name from the position of the shutter (see page 34)

The Reflex Camera

Focal plane shutters are invariably fitted to reflex cameras The "king of cameras" is an ideal instrument, but rather expensive and bulky The great feature of the camera is the "chimney" down which one looks on to a mirror, inside the camera where the picture is seen By this means it is possible to see exactly what the photograph will include, and to focus the subject to the moment when the release is pressed, the mirror moved out of the way, the shutter released, and the exposure made It will be realized that for photographing rapidly moving objects the reflex camera is ideal. The cheapest patterns cost about £10

Field (or Stand) Cameras

In the early days of amateur photography the quarter-plate ($4\frac{1}{4} \times 3\frac{1}{4}$ inches) and half plate ($6\frac{1}{2} \times 4\frac{3}{4}$ inches) field cameras were in universal use The larger size still retains its popularity among many serious workers but the quarter-plate size has somewhat fallen into disuse because almost equally good work may be done with the more portable "hand" camera of this size, when mounted on a tripod

Cameras of the field type taking plates up to 15 × 12 inches are in common use among professional workers, but the amateur rarely goes above the half plate size Field cameras cannot be used conveniently in the hand

Stand cameras have many adjustments and fittings that make them almost indispensable for certain kinds of work. Some have very long extensions which enable the worker to place the lens at three times its normal distance from the plate—a useful feature when copying

A really good field camera has back and front focussing, swing back and other fittings of special use when photographing architecture, but these fittings have the disadvantage of making the camera rather heavy

Obviously it is impossible to tell the reader what type or which make of camera to purchase, as much depends upon the money to be spent upon it and the kind of work to be undertaken. The writer's preference after many years of practical photography rests with the following three types a 3½ × 2½ magazine roll film camera, a ¼ plate reflex camera and a ½ plate field or stand camera.

Roll film and magazine plate cameras are self-contained and need no dark slides, but all field cameras and all but magazine hand cameras for using plates require some arrangement for inserting the plate or flat film in the camera and removing it after exposure The three methods of doing this are by means of (1) dark slides, (2) daylight-changing envelopes and (3) changing boxes

The commonest system of carrying plates is by means of dark slides which are simply flat boxes with sliding lids There are two forms of slides one the double or book form, which takes two plates and the other the single slide, usually of metal, which holds only one plate

The envelope system known as the Mackenzie-Wishart, is

A changing box is an apparatus which holds several plates (usually a dozen) this box is fitted to the back of the camera, and the plates are brought into position as required

CHAPTER II

THE LENS

The Why and Wherefore of the Lens

WHY is a lens required at all? As it is possible to obtain a photograph without a lens, the question is reasonable enough and demands a rather full answer.

To realize the answer to that question one must bear in mind that every visible object reflects light. This light does not proceed from it in one mass, but in the form of innumerable fine rays, which radiate from each point on the object rather in the way that water proceeds from the spray of a garden hose. If, therefore, a photographic plate or film is placed opposite a visible object, the light rays proceeding

held before a house, for instance, each spot on the plate would be affected by a ray from every visible part of that house—a certain spot would be acted upon not only by the rays from the chimney, but by rays from a window or a door. In other words, there would be no selection of rays, and therefore no portion of the plate would be left unaffected, and the developed "negative" would be uniformly black.

"Selecting" the Light Rays

Obviously the remedy is to screen off those rays which are not required; and the common way of doing this is to place between the plate and the object—say the house—an opaque screen, pierced by a hole so small that only one set of rays from each component of the object has access to the plate: i.e. the rays from the chimney affect only a certain portion of the plate, and the rays from door and windows affect other portions of the plate.

That is the principle of pinhole photography. It is indeed one of the principles of all photography

Owing to the need for very rigid selection of rays it follows that the hole in the opaque screen must be very small indeed with the consequence that illumination of the plate is very poor and a very long exposure is needed

The Function of the Lens

By the use of a lens, however, one may increase the size of the hole very considerably, so that the exposure may be reduced to a small fraction of a second

This enlargement is made possible by the action of a lens in *bending* or more accurately deflecting all light rays which come in contact with it

For example, if instead of leaving just a clear little hole in the screen separating the house from the plate, we enlarge the hole in the screen and insert in it a suitable lens what will be the effect ? The deflecting action of the lens will cause the rays emanating from the chimney and striking the front of the lens to be deflected in such a way that all of them fall on one given part of the plate only

The Principle of the Lens

In order to get an exact understanding of the action of a lens, it is necessary to repeat that rays emanate from *each point* of a visible object therefore the rays which we have spoken of as coming from the chimney actually come from thousands of points on the chimney—from every point, however small which is capable of reflecting light Let us endeavour to see how the lens affects the rays from such a point as the clearest corner of the chimney Though the

surface of the lens, but, owing to the fact that a lens deflects rays according to the curvature of its surfaces these rays, on emerging from the farther side of the lens, tend to converge, and at a certain distance from the lens will meet at a point known as their *focus*. The distance of *that* point from the lens is known as the *focal length* of the lens when the object concerned, for instance the house, is at a distance of, say, fifty yards or more

It will be seen from this description that unless the plate is at a certain determined distance from the lens the rays from the point of the chimney will not affect one spot, but will affect, instead, a small group of spots similarly rays from every light reflecting point of the building will affect, not single spots but small groups of spots It is these groups of spots which produce the ' fuzzy ' effect obtained when lens and plate are out of focus

Why Common Lenses Fail

Ordinary white light is made up of different rays which when separated appear as violet blue, green, yellow, orange and red—the colours of the spectrum.

When these separate colour rays pass through a non achromatic lens (such as a magnifying glass or a spectacle lens), they are not all deflected to the same extent The violet and blue rays, which most influence the sensitive surface, come to their focus at a shorter distance from the lens than the other rays which produce the strongest part of the image on the focussing screen.

The Achromatic Lens

The achromatic lens which is a single lens (so called) constructed of lenses of different focal lengths and of more than one kind of glass ' levels up ' the images on the focussing screen and the sensitive surface, and makes it possible to reproduce the object as clearly as it is focussed.

Astigmatism is also found in actual single lenses a defect which results in the image, except in the centre of the field, being blurred. Lenses corrected are called anastigmats

Three types of lenses are in common use among amateur photographers namely (1) the single, (2) the double or rapid rectilinear, and (3) the anastigmat

The Single Lens

The single lens (Fig 1) is the cheapest type of lens, it is sometimes called a ' landscape lens, some prefer to call it an ' achromatic ' lens while with others it goes by the name of a "meniscus." The single photo-

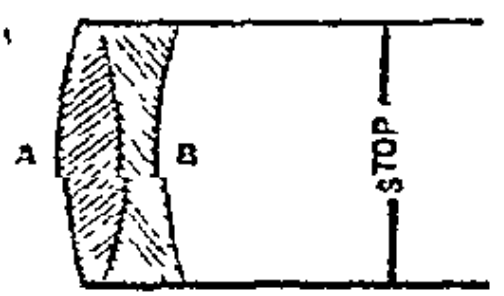

FIG 1

graphic lens is not actually a single lens like a reading glass or a spectacle lens, it is made by cementing two "glasses" together in such a way that they appear to be one lens, there are several forms of this type of lens, but the usual plan of making it is to cement a meniscus lens (A) to a correcting lens (B) the two together making a really good combination This plan is adopted because no real single lens will give an image entirely suitable for photographic purposes

The corrected lens is excellent for photographing landscapes, but it will take portraits and many other subjects equally well, in fact some professional workers prefer a single lens for portraiture. Single lenses usually have F 11 as the largest stop (a point to be explained in the next chapter)

"Double" or Rapid Rectilinear Lenses

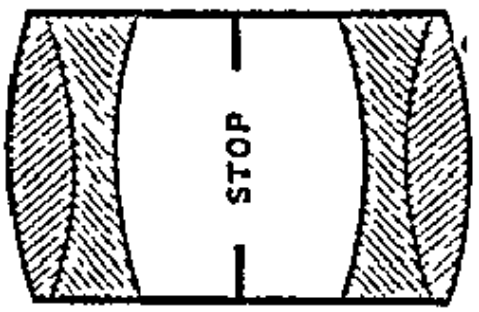

FIG 2

Rapid rectilinear or "double" lenses are better and more costly than single lenses Double lenses of the R.R. (rapid rectilinear) type (Fig 2) consist of two combinations (as Fig 1) mounted in one tube with a diaphragm (or stop) between them By mounting and using two so-called single lenses in this way certain minor defects of s the res and the ge of the R.R. lens is that either of the two combinations forming it can be used as a single lens each of which has about double the focal length of the complete lens An R.R. lens whose focal length is 8 inches, for example, consists of two lenses each 16 inches in focal length.

Anastigmat Lenses

Anastigmat lenses are now the best and most costly forms of lenses, they are a very much improved type of double lens and there are scores of different patterns They usually consist of more than four "glasses," and one make with six "glasses —three at each end of the tube—is shown in Fig 3 Some makes have five "glasses" and some only four or

even three "glasses," but their shape differs from those forming the R.R. lens, and sometimes there is an air space between the glasses at the ends of a tube, as well as the space where the stop is placed.

Anastigmats give really perfect images and are very much faster than the cheaper R.R. lens; the largest aperture in ordinary use is F. 4·5, but more rapid lenses are obtainable. Even with F. 8 and F 11 stops the anastigmat is better than the double and single lenses because it gives a finer image, and all who can afford an anastigmat should have one.

A convertible anastigmat means that the lenses forming it can be used singly (as R.R. lenses may be separated and used). Anastigmat lenses which are not convertible can be used only in their complete (one focal length) form.

Wide-Angle Lenses

Wide-angle lenses are those which take in a wider view than lenses of normal focal length. (See under Angle of View, p. 20.) They are used mainly upon stand cameras fitted with a focussing screen for architectural work, particularly interiors, and for exteriors when the photographer has to work in confined situations.

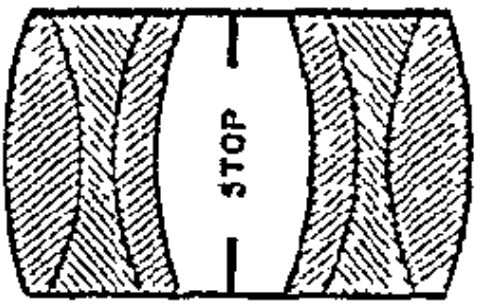

FIG. 3

Wide-angle lenses are slower than ordinary, and unless carefully used are apt to reproduce in faulty perspective.

Portrait Lenses

Portrait lenses are heard little of to-day; they are of small use to the amateur, although the professional studio worker employs them. As a matter of fact, the modern anastigmat will do all that a real portrait lens can do.

A feature of the portrait lens is its rapidity.

Portrait Attachments

Portrait attachments are really supplementary lenses (to [illegible] of their low [illegible] extra lens [illegible] urrel of the regular lens. It so alters the focal length of the camera lens

that an image large in proportion to the size of the picture may be secured since the camera can be placed closer to the subject Although called a "portrait' attachment, it may be used equally well for flowers still life studies etc , in cases where the camera has no focussing arrangement, or when the extension will not rack out far enough

Magnifiers

The lenses fitted to fixed focus plate cameras of the box form do not render sharply objects nearer than say, 12 feet, but a form of supplementary lens, known as a magnifier, is used largely on such cameras It is a single lens for attaching to the usual fixed focus' camera lens and alters its focal length thus allowing near objects to be focussed without altering the distance between lens and plate or film Three or four such lenses are fitted to some cameras so that any one of them can be placed in front of the proper lens They are marked with numbers indicating distance in feet, thus, a magnifier marked 5 used in conjunction with the camera lens focusses on the plate or film an object 5 feet distant from the lens, and so on

Supplementary Lenses

Supplementary lenses are extra single lenses used to lengthen or shorten the focal length of the ordinary camera lens Portrait attachments and magnifiers (referred to above) are supplementary lenses

Supplementary lenses are of two kinds—positive (magnifying) and negative (diminishing); the former is used for shortening the focal length of a lens and the latter for lengthening it

The rule for finding the focal length and combining is a little curious but very simple multiply the focal length of the camera lens to be altered by the focal length you want it to be, next divide the product by the difference between the two focal lengths and the result will be the focal length of the supplementary or spectacle lens to be added Thus to make a lens of 5 inches focal length into one of 8 inches focal length, the sum would be $8 \times 5 = 40$, divide by 3 (the difference), and we get $13\frac{1}{3}$, therefore a spectacle lens (negative pattern, which lengthens) of $13\frac{1}{3}$ inches focal length added to any camera lens of 5 inches focal length will convert it into one of approxi-

mately 8 inches focal length. To shorten a 7-inch lens to
5 [illegible] × 5 = 35,
[illegible] therefore
[illegible] 7½ inches
focal length added to a camera lens of 7 inches focal length will make it into one of 5 inches. One cannot, however, always get supplementary lenses of the focal length desired, and in such cases the nearest obtainable should be secured. This rough and ready plan is not scientifically accurate, but is correct enough for practical work.

Soft-Focus Lenses

During recent years lenses for securing an artistic "softness" of the image have become popular. Many photographers prefer softness in pictures to needle-sharpness, and some get such softness either by placing an ordinary lens a trifle out of focus (a spectacle lens focussed sharply will do it), by enlarging through chiffon, or by other methods. The more up-to-date worker, however, prefers a lens specially made for soft effects, but amateurs who use them are apt to be disappointed with the results they give.

Telephoto Lenses

Telephoto lenses are used for securing large and defined images of distant objects, as seen through a telescope. Telephoto lenses are of various types, but mainly they may be divided into two classes: (1) those that are complete in themselves and are used in place of an ordinary lens, and (2) those that require to be used with the ordinary camera lens. The former are the more modern or popular type.

CHAPTER III

STOPS AND OTHER OPTICAL MATTERS

STOPS—sometimes called diaphragms—are the perforated plates or—an adjustable type—the iris placed in front of a single lens and between the lenses of an R R or anastigmat lens In a cheap lens particularly one of the single pattern the stop may be fixed, but in better lenses it is possible to alter the size of the aperture There are many methods of altering the size of the stop, but the best of all is the iris form of diaphragm

Systems of Numbering Stops

There are two systems of numbering stops—the "F" and the 'U S (universal) systems The "F system is most common, but many American makers prefer the "U S" system The F number is arrived at by dividing the focal length of the lens by the diameter of the stop thus a ¼-inch stop in a 4 inch lens is F 8 while a ⅛-inch stop with the same lens would be F 16 It is therefore a simple matter to measure stops and mark them with F numbers if they are not so marked, and as most exposure tables meters, etc., are based on F numbers, it is desirable to know the dimensions of all stops likely to be used.

To find the U S number of any F stop simply divide the F number by 4 and square the result, thus F 24 is U S 36, since 24 — 4 = 6 and 6 squared is 36 To reverse the process and find the F value of any U S number, take the square root of the latter and multiply by 4

All good lenses are properly marked with some F numbers, and the larger the "hole" with a given lens the lower the number, 16 is smaller than 11 4 5 larger than 8 and so on. The speed of all lenses at the same 'stop is the same although the "holes" are not equal in diameter, since the

sizes depend upon the focal length of the lens—the diameter of the F. 8 stop is one-eighth the focal length of the lens, and as the focal length varies in different lenses so does the diameter of the stop.

Stops and Speed

Stops govern the speed of a lens and regulate the clearness of details and planes (distances) in a picture. What stops do in the matter of speeding up or slowing down a lens is fully described in the chapter on "Exposure," and the work they do in other directions will be dealt with as occasion demands. Stops do much to improve a poor lens.

Focal Length

[illegible] wh [illegible] me [illegible] in double lenses the measurement is taken from the stop. Many lenses have the focal length engraved upon the mount.

Upon the focal length of the lens depends the size of the image and amount of picture included. Normal focal length, and the one in common use (because it is the best), is the diagonal of the plate or thereabouts. Thus a lens of 5½ inches focal length is suitable for a quarter-plate, because that is the approximate measurement of the diagonal of the plate. It is better for a lens to be of a focal length greater than the diagonal rather than less: many photographers favour a normal focal length of 1⅓ times the diagonal. The lenses usually fitted to the smallest pocket cameras include a greater amount of view than lenses fitted to other sizes.

The size of an image produced by a lens is in exact proportion to the focal length, and has nothing to do with the size of the plate for which it is designed. For example, if we have two lenses, one a quarter-plate of 5 inches focal length and the other a half-plate of the same focal length, the images will be exactly the same size from the same standpoint, but the half-plate will include more of the view.

Various images of any subject taken from the same standpoint will vary in size in proportion to the focal lengths of the lenses employed, i.e. an object appearing 1⅓ inches on the screen with a lens of 5½ inches focal length would be 3 inches if a lens of 11 inches focal length were used.

Angle of View

The terms wide and narrow angle are confusing and unsatisfactory, because the matter depends upon the focal length of the lens and what size of plate or film it will cover or is used for Let us take for instance a good half plate lens of 8½ inches normal focus, this used on a quarter plate will act as a narrow angle lens and take in very little of the view, simply because the quarter plate will receive only a small part of the picture cast by the lens, the same lens, however, used on a whole-plate would act as a wide-angle lens, because more of the image would be taken in by the larger plate This point is illustrated in Fig 4 which is exaggerated to explain the problem more clearly The lens (one focal length) is as shown with the three sizes of plates (or films) behind it The quarter plate could only take in the image included between the parts C, whereas the larger half plate could take in more, namely, the B portions, while the A rays which we may term wide-angle, would take in very much more and so fill an 8½ × 6½ plate

This question of angle of view is illustrated in yet another way in Fig 5 Here we are supposed to have only one size of plate or film The amount of picture included in this case would depend upon the focal length of lens used. If the focus were at B, then the rays C would proceed from the edges of a scene much larger than if a lens of longer focal

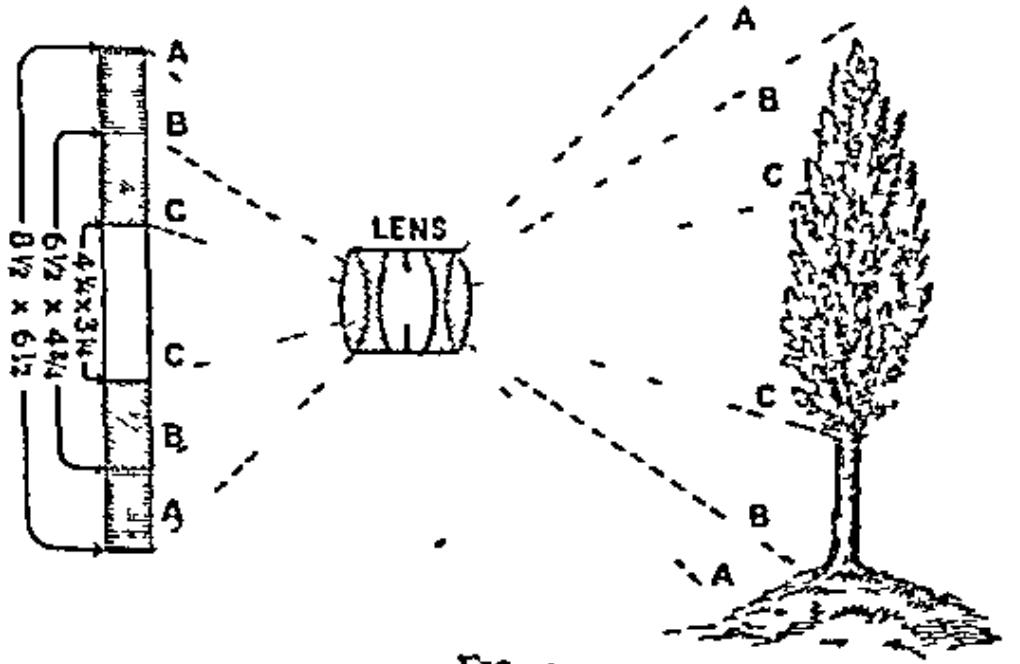

Fig 4

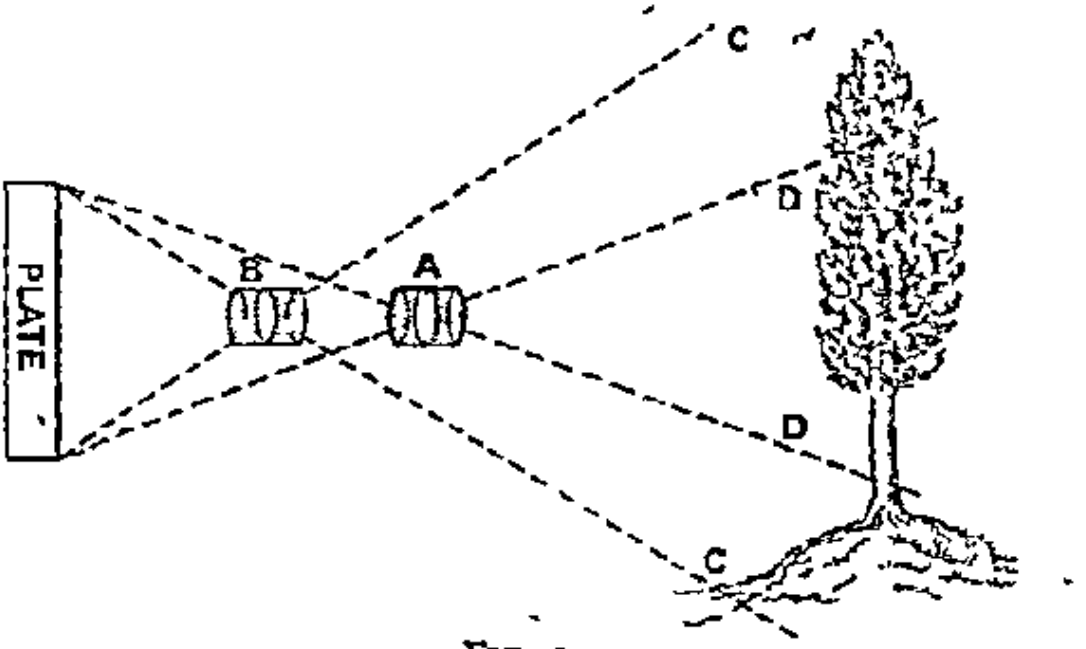

FIG. 5.

length were used ; the latter, A, would take in only those parts included between the D rays, assuming of course the two lenses were used at the same standpoint. The A lens, however, could be made to take in as much as the B lens by placing the camera at a greater distance from the object. In the two diagrams, Figs. 4 and 5, the camera bellows between lens and plate are omitted so as to simplify the sketches.

Users of hand cameras are generally unable to vary their angle of view—and here it may be mentioned that a few simple tests will go far to mitigate the vagaries of a "view-finder"—but the user of a stand camera who has a battery of lenses often makes a close study of angle of view.

Distortion

Distortion of the image in photographs, especially those taken with hand cameras, is more often due to the camera having been tilted than to any defect in lenses, though lenses are frequently blamed.

Only single lenses distort a view, and even when they do the defect is not often noticed. What single lenses do, especially those of short focal length and bad covering power, is to represent straight lines a little curved, but only when such lines are near the edges of the picture.

CHAPTER IV

HOW TO FOCUS

FOCUSSING with an ordinary folding hand camera is a very simple matter If it is desired to photograph an object, say, 15 feet distant, the front of the camera is pulled out until the pointer upon it rests against the 15 feet mark on the scale When fairly near objects are focussed in this way, other objects either nearer or farther from the camera, will not be absolutely sharp This, however, depends largely on the size of stop used in the lens This subject of depth of focus is fully described later in this chapter

Focussing Near Objects

The nearer the object to the camera the more accurate must be the estimation of the distance between camera and object photographed, and great care must be taken in focussing, particularly when a large stop like F 4 5 or F 6 is used These large stops, however, have one advantage—that they permit of selective focussing, i e the focussing of the chief object perfectly sharp, with all other objects diffused

The Principles of Focussing

In Fig 6 is shown a lens in section; the nearer an object is to this lens the greater the distance necessary between the lens and the film to reproduce it clearly Thus, if the point *a* quite near to the camera were focussed, the film would be at A, the distance between the lens and A decreasing as the distance between the lens and *a* increases

Obviously this decrease cannot be very considerable, other-

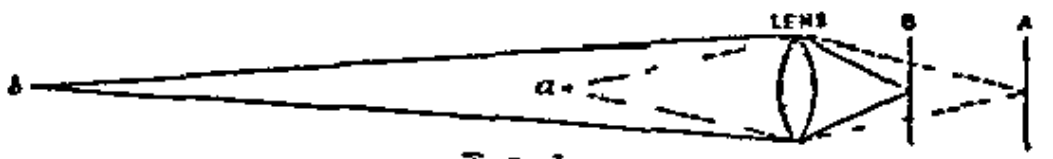

FIG 6

wise the lens and film would soon touch There comes a time—depending upon the focal length of lens and diameter of stop—when all objects at a certain distance and all beyond it are in focus

In Fig 6 this point (called infinity) is shown at *b*, this point being in focus when the film is at B

The principle of focussing by scale, as in so many folding cameras, is illustrated in Fig 7, in which A represents the

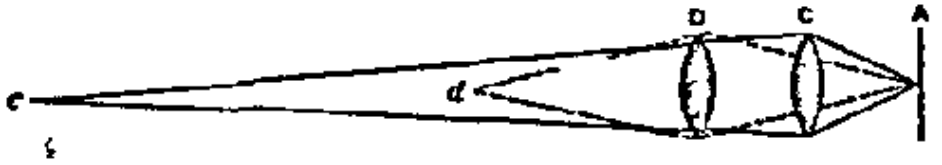

Fig 7

film The lens if focussed for a near object (*d*) would be at some distance (D) from the film but by taking the lens closer to the film (as at C) all objects at and beyond (*c*) would be in focus It should be understood that if (*d*) (Fig 7) were focussed only this point (*d*) would be in focus very little nearer to or farther from the camera would be clearly defined.

The Use of Stops

By sacrificing the clearness of near objects however, the camera maker adjusts the lens to reproduce clearly all objects at and beyond a certain distance

The sketch (Fig 8) illustrates this point, it shows a

Fig 8

camera with a figure at a distance When the largest stop is used in the lens nothing nearer than this distance will be clearly defined

This distance (although called "fixed') may be altered and regulated by the use of smaller stops but it must be remembered that small stops mean longer exposures, and that if subjects are taken at too short a distance hand camera exposures are out of the question Thus if, say, F 4 5 were

used the figure might be in focus at a distance shown in Fig 8, by using F 8, however, the figure would be in focus nearer to the camera, or if F 16 or F 32 were employed, the figure could be still nearer the camera, and everything beyond the figure would still be in focus the smaller stops in this case not affecting the details beyond the infinity point

We will deal with exposures and the values of stops in a later chapter, so all we need say here in reference to Fig 8, [illegible] camera on a rest of some kind so that a time exposure could be given. The distances in Fig 8 are drawn to scale, and are those for a lens of 3 inch focal length

Depth of Focus

Depth of focus means the distance a focussed near object may move to or from the camera without getting out of focus, and the point (which depends upon focal length of lens and stop

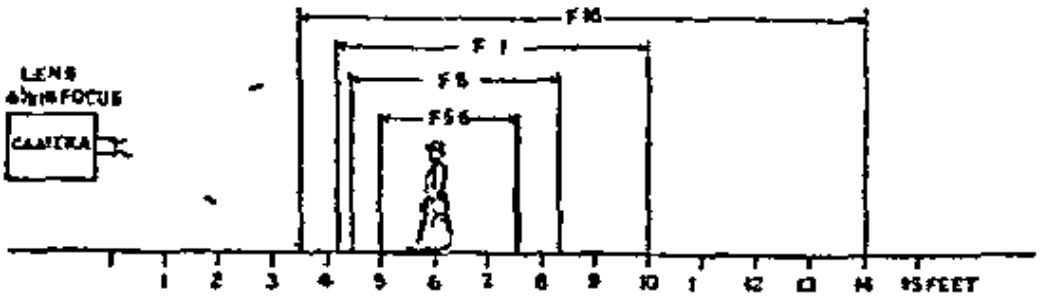

FIG 9

used) is illustrated in Fig 9 If a lens of 4½ inches focal length is used and an object 6 feet away is focussed sharply with F 5 6 all objects between 5 feet and 7½ feet from the lens will be sharp enough, should F 8 be used (for the same 6-foot object) everything between 4 feet 8 inches and 8 feet 4 inches will be sharp, with F 11 the depth of focus is between 4½ feet and 10 feet, and with F 16 it is between 3¾ feet and 14 feet The rule for finding these distances for all lenses and stops is First find the hyperfocal distance To do this, square the focal length of the lens in inches, multiply by 100, and divide by the F (stop) number The result is the hyperfocal distance Then to find the depth, multiply the hyperfocal distance by the distance from the lens of the object

focussed. The result of this multiplication is then divided, first by the hyperfocal distance with the distance of the object focussed added to it, and then again by the hyperfocal distance with the distance of the object focussed subtracted from it. The first result gives you the nearest object which will be sharp, the second the farthest. (See also table below.)

Focussing near objects by means of a scale needs a little practice. The beginner, therefore, is advised to begin with photographs of distant objects and to use the lens at the infinity mark.

Hyperfocal Distances

The accompanying table of hyperfocal distances is of service to hand-camera workers as it gives the distances for lenses of different focal lengths when used with various stops. A trick of the trade—a very good one—is said to be that of making the fixed-focus distance a trifle nearer than infinity, because most amateurs want to photograph objects nearer the camera than the real infinity, but not so near as to upset the rendering of distance details.

DISTANCES IN FEET AT AND BEYOND WHICH ALL OBJECTS ARE IN FOCUS

Focal length of Lens in Inches.	F No. OF STOPS.							
	4·5	6	8	11	16	22	32	64
	Number of Feet.							
3	17	12	9	7	4	3	2	1
3½	22	17	13	9	7	4	3	1½
4	29	22	17	12	8	6	4	2
4½	37	28	21	15	10	7	5½	3
5	46	35	26	18	13	9	6½	3½
5½	54	43	32	22	16	11	7½	4
6	66	50	38	27	19	14	9	4½
6½	78	58	44	31	22	16	11	5½
7	90	68	50	36	25	18	12½	6
8	108	88	66	48	33	24	16	8

If the lens is fixed for the hyperfocal distance (as per table), definition is secured from half the distance named to infinity, thus with a 4-inch lens at F. 8, focussed on a distance of 17 feet,

objects between 8½ feet from the lens and infinity will be pictured clearly If however the lens be focussed on the actual infinity (the greatest distance) the figures in the table indicate the nearest point the object may be to the camera

Fixed focus Cameras

Fixed focus cameras—usually very small ones—are those which require no focussing in fact there is no arrangement for focussing the lens being fixed by the maker at such a distance as to give the best average result

At first sight it may be thought that fixed focus cameras are the very thing to have for why bother about focussing when there is no need to do so? The answer to this is that while fixed focus cameras are excellent for certain kinds of pictures they have their limitations and cannot photograph some of the nearer objects as can a focussing camera

The Focussing Scale

Folding cameras are usually focussed by reference to a focussing scale placed on the baseboard of the instrument a pointer being fixed upon the camera front carrying the lens.

The distances on scales are usually marked in feet or yards though many cameras made on the Continent are graduated in metres (M) Very small cameras are usually marked in feet and larger ones in yards but all good scales say which they are and some scales have both markings

At the end of the scale is the INF (infinity) mark—sometimes written like a figure 8 on its side (∞)

Focal plane cameras have the focussing scale engraved upon the lens which moves to and fro in its mount A lever or arm moves the lens and indicates distances

CHAPTER V

MAKING THE EXPOSURE

EXPOSURE is a matter of the greatest importance to the photographer, but thanks to exposure meters and tables one is able to calculate exposure fairly easily. The latitude of plates and films is also very great, as it allows for a certain amount of error. If, for example, the correct exposure were 1 second, an exposure of ¾ of a second, or perhaps ½ a second, might give a passable negative, as might also an exposure of 2 or 3 seconds. The wrong exposures might render plates unattractive in themselves, but negatives are judged solely by the prints they give, and the most unlikely, if carefully printed, will often give good prints. But only an accurate exposure will produce the perfect negative.

Factors Governing Exposure

Before dealing with exposure meters and tables the four factors governing exposure must be considered; they are: (1) Size of stop in lens, (2) Rapidity of plate or film, (3) Strength of light, and (4) Subject.

At first sight this appears to be a complex problem to master, but it can, at the start, be made easy by keeping to one stop and one speed of plate or film, thus "standardizing" two of the factors

Sizes of Stops

Stops have been described and discussed on page 18. To some this factor is, perhaps, the most confusing of all, although the matter is really very simple. The rapidity of a lens, or the effect it has on length of exposure necessary, depends upon the F value (or number) of the stop used. It matters not whether the lens is a single or a double one, or whether it costs a few shillings or many pounds, because F. 16 (or

any other number) is of the same exposure value with all lenses The exposure varies according to the F numbers squared F 16 requires four times the exposure necessary for F 8 and not twice the exposure as might be supposed. It is a simple matter to calculate the exposure of any stops according to this plan For example how much faster is, say, F 6 than F 8? The square of 6 is 36 and of 8 is 64, therefore the exposure is as 36 is to 64 or as 2¼ is to 4 Thus if F 8 wanted 4 seconds F 6 would require 2¼ seconds.

It may be further explained by taking F 8 as a standard and assuming it to require an exposure of 1 second If this is done the proportionate exposures for some of the other stops would be approximately as follows

F	4.5	5.6	8	11	16	22	32	45
	⅓	½	1	2	4	8	16	32

This does not mean that F 4.5 always requires one-third of a second but that it requires one-third the exposure necessary with F 8 The point to bear in mind is that a rapid F 4.5 lens used at F 16 is no faster than any other or cheaper lens used at F. 16

Rapidity of Plate or Film

The speed of a plate or film is indicated by a number—known as the "H and D" number—which the maker puts on the box. There are often two sets of numbers on a box, one (often very high) is the batch number, and the other (usually a lower one) is the "H and D" number "H and D" stands for Hurter and Driffield, whose system of numbering it is The terms "ordinary," "rapid," "extra rapid," etc., as applied to plates and films are not very satisfactory, and are often loosely employed hence the introduction of the more accurate "H and D" system of numbers. The higher the H and D number the more rapid the plate and the necessary increase and decrease of exposure are in proportion to the numbers If the amateur uses a plate or film marked, say, "H and D 200 with good results and then goes to one marked "H and D" 400 the latter is double the speed of the former and needs only half the exposure A good speed for average work is between "H and D" 250 and 350 Ordinary plates slow for landscape work are about 100, while the highest speed plates are about "H and D" 650

Of small differences—say up to 50—no notice need be taken, because of the great latitude of plates and films.

Speed numbers known as "Watkins" or "Wynne" numbers are often used; these were invented and employed on plates and films by the Watkins and Wynne firms for use with their exposure meters.

Happily the speed numbers are convertible. To convert "H and D" into "Watkins" simply multiply "H and D" by 50 and divide by 34; to convert "Watkins" into "Wynne," extract the square root and multiply by 6·4. The amateur should always use the slowest plate that conditions will allow.

Light

The two items considered above will not trouble the amateur who keeps to one stop and [illegible] one can hardly disregard [illegible] variation in both these [illegible] advised to keep both the stop and the plate speed constant until he is quite familiar with the problems of light and

year, is given below:

PHOTOGRAPHIC VALUE OF LIGHT

Proportionate Length of Exposure while Sun is Shining

(*Unit 1 second.*)

Hour of Day		June.	May, July.	April, Aug.	March, Sept.	Feb Oct.	Jan. Nov	Dec.
a.m.	p.m.							
	12	1	1	1½	1½	2	3½	4
11	1	1	1	1½	1½	2½	4	5
10	2	1	1	1½	1½	3	5	6
9	3	1	1½	1½	2	4	12	16
8	4	1½	1½	2	3	10	—	—
7	5	2	2½	3	6	—	—	—
6	6	2½	3	6	—	—	—	—
5	7	5	6	—	—	—	—	—

NOTE.—These are *Real* times; *Summer* times are one hour later.

This table shows at a glance how (when the sun is shining) the value of light varies, and it of course varies still more when the sky is cloudy

It is, however, not always sunny in this country and the

dull light quadruple it

Many hand-camera workers give the same exposures for objects seen in diffused light (no direct sunlight) as they would give on a cloudless day, which is wrong—if stop and plate remain the same, double the exposure is required.

It is worth noting that in cases where absolutely correct exposure cannot apparently be obtained, owing to the speed at which the shutter is set to work, the difference can often be adjusted with the aid of the stop

For work with cameras provided with one diaphragm and only the bare "time" and "instantaneous" shutter variations it is useful to carry a range of plates of varying speeds —this provides a method of adjusting matters to obtain a correct exposure It should be—but experience teaches that it is not—needless to add that careful note should be made, before setting out of the contents of each dark slide

Subject

Lastly, there is the subject to consider, this is as important as the question of light, and the following table shows how the character of the view (apart from the quality of the light) influences the exposure

	Proportionate Length of Exposure. (*Unit* 1 *Second*)
Sea and sky	$\frac{1}{4}$
Panoramic view from hill or tower	1
	$2\frac{1}{2}$
	3
	4
	5
	80
Interiors	upwards of 100

The last two are at all times, doubtful because the subjects vary so widely, but the other items are fairly reliable

(The figures, it must be understood, do not indicate actual times of exposure in seconds but are only units for comparison The table shows, for example that an ordinary landscape with no near shadows requires ten times the length of exposure necessary in a view of sea and sky It is very difficult indeed to lay down any definite rules on this subject because of the varying nature of subjects A golden rule is to expose for the shadows and to let the high lights take care of themselves

Estimating the Exposure

It is impossible to give in print the exact exposure for any subject, because of the many conditions governing it The beginner, however, will look for some guide be it ever so rough

Assuming that the films and plates (of average speed) are used at midday during May, June and July, when the sun is brilliant, we might estimate the exposures to be as follows.

EXPOSURE TABLE
(*Time in Seconds*)

Stops. F No.	Sea and Sky	Open Landscape.	Average Landscape.
4 5	$\frac{1}{250}$	$\frac{1}{125}$	$\frac{1}{100}$
8	$\frac{1}{125}$	$\frac{1}{75}$	$\frac{1}{50}$
11	$\frac{1}{75}$	$\frac{1}{50}$	$\frac{1}{25}$
16	$\frac{1}{50}$	$\frac{1}{25}$	$\frac{1}{10}$
22	$\frac{1}{25}$	$\frac{1}{10}$	$\frac{1}{5}$

These are only approximate Exposures for other stops, subjects light and plates can be roughly estimated by multiplying or dividing by the numbers given in the preceding tables

Exposure Tables and Meters

There are numerous exposure tables calculators, and meters in existence all designed to assist the photographer and to make simple the problem of exposure Most makers of plates and films issue tables specially compiled to suit their own products while some firms issue tables and calculators applicable to all makes of plates and films

to deal In the most popular form of exposure meter a piece of sensitive paper darkens when exposed to light, as soon as the time of darkening has been ascertained, very simple calculations tell one what exposure to give . But there are also several other patterns

With exposure tables one has to decide whether the light is bright, diffused, dull etc, and, as opinions on the point may differ, there is always the chance that wrong calculations will be made if this is left to guess-work, hence the advantage of light measuring meters

An exposure calculator, which works without sensitive paper, may be purchased from any photographic dealer.

Shutters

The most primitive method of making an exposure is by means of a lens cap Many "time" exposures are made in this way It is impossible to give a very brief exposure with a cap, ½ a second is possibly the shortest, and is often referred to as "cap off and on." It requires a little practice to do this without shaking the camera. The correct method of giving quick exposures with a cap—say ½ a second to 2 seconds—is first to remove the cap from the bottom of the lens mount, keeping the top near or touching the mount, and then to work the cap as though it were hinged to the top of

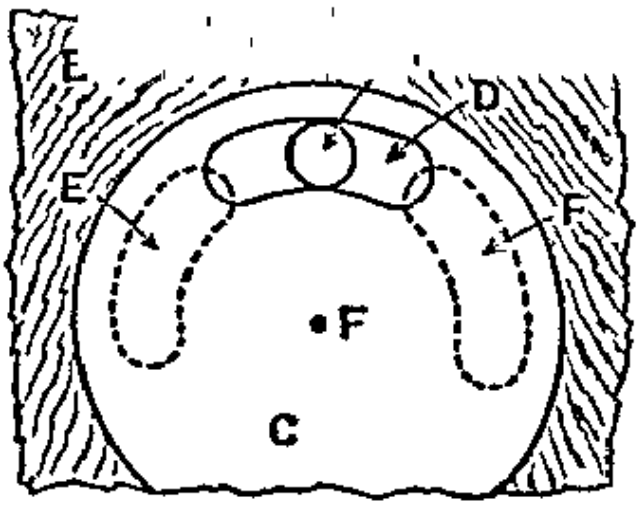

FIG 10

shade" for the lens, and its nearness allows the cap to be replaced very quickly and with no "fumbling"

Shutters are better and more convenient than caps for making exposures, and many scores of very clever inventions for exposing

are now on the market The simplest form of shutter in common use to-day is the one-speed to and fro pattern (Fig 10) (A) is the lens in the camera front (B), in front is a circular or other shaped plate (C) which revolves on a pivot (F) but does not make a complete revolution In it is an aperture (D) which passes before the lens thus making the exposure Before the exposure the lens is covered by the plate the aperture being at (E or F), by means of a lever the plate is partly rotated—bringing the aperture to the opposite side The speed is usually about $\frac{1}{25}$th of a second There is also an arrangement for causing the aperture to remain opposite the lens for a certain period, so as to give "time" exposures

Another Type of Shutter

A more popular and most efficient shutter, of which there are many different patterns, varying slightly in detail but all working on the same principle (roughly comparable to a "scissors" movement), works between the combinations of the lens usually by the opening and closing of two metal or vulcanite plates The speed is adjusted by means of a dial, which operates a pneumatic valve, the shutter is set by means of a lever and released by means of a trigger finger or a pneumatic or other release A level controls the stops, which are behind the two plates, and the shutter frame serves as the lens mount or tube

The letters "B, T and I," "T and I, or "T and B" are to be found on most shutters the initials standing for "Time," 'Bulb' and 'Instantaneous" Many German made shutters are on the market, and on some of these the letters Z (Time), D (Bulb) and M (Instantaneous) are to be found A pointer is placed against whichever method of exposing is required

Making Time and Bulb Exposures

"Time" exposures are made by pressing the trigger or other release after the shutter has been set The pressure is then taken away and the lens remains open the exposure continuing until the release is pressed a second time, this latter movement closing the lens

For "Bulb exposures the bulb is pressed and the shutter opens and remains so as long as the pressure is maintained,

but closes the moment the pressure is relaxed Obviously "bulb" exposures of any required duration can be given for so long as the pressure can be kept up Bulb exposures are however, usually given when short time exposures are desired—say, 1 ¾ ½ and ¼ of a second, these exposures are sometimes too long for the 'instantaneous' movement and too short for the time" movement 'Instantaneous" speeds (with the pointer at "I") are usually given on a dial, which is revolved and set according to the speed required

Roller-Blind Shutters

Roller blind shutters are used mainly on stand or field cameras and fit on the front of the lens or on the camera front In the latter case the lens is mounted on the shutter Across the opening travels an opaque blind (mounted on a spring roller) in which is an aperture A lever indicates 'Time" and 'Instantaneous,' and a spring controls the speed The shutter is set by pulling down the blind by means of a tassel and is released by means of a pneumatic ball and tube or similar device which lifts a lever, and causes the apertured blind to travel in front of the lens

The Focal-Plane Shutter

The focal plane shutter is similar to the roller blind, but larger It is a trifle bigger than the picture for which it is to be used, the complete shutter being fitted immediately in front of the plate or film (hence the name), and not upon or immediately behind the lens. In the blind is an aperture which passes before the plate and exposes it (the lens being open the whole time) A spring and a release operate the shutter as in the case of the ordinary roller blind shutter This instrument is fitted to most cameras of the reflex pattern, and is capable of extremely rapid exposures, even up to $\frac{1}{2000}$th of a second

CHAPTER VI

THE HAND CAMERA

THE routine of taking a photograph with a hand camera may be summarized thus (and the beginner may be recommended to adhere to such a routine until such time as he can abandon it without fear of omitting some slight but important operation). Having opened the camera and made sure plates or films are in position, estimate the distance between lens and subject and focus accordingly; get the desired view in the finder; make the exposure, and then immediately change the plate or film.

Always change a film or plate immediately after making an exposure, as by so doing one does away with the danger of making two exposures upon one film or plate. It is so easy to put off changing until a more convenient moment—and then to forget to do it.

Happily all makers of good hand cameras supply free booklets describing the manner of using them. It would take up too much space to describe the many methods in detail: all we can do is to give a few hints on the use of hand cameras in general.

One should be well acquainted with all the movements of a camera before loading and using it. All the fittings, spool-changing or plate-changing movements, lens stops, focussing scale, and methods of opening and closing the camera should be examined at the outset.

Having mastered the business of loading, the beginner may be glad of a few notes concerning—

Holding the Camera

The proper way of holding a camera depends upon the make of the instrument and the pattern of the view finder. Cameras with finders that are looked into from above should be held pressed against the body, with the head bent over

the finder. Holding the camera a little away from the body is not to be recommended, because of the danger of moving it when giving the exposure, the pressing of the shutter release often bein
or blur the outlin
against the body
a trigger release do not yield to the tendency to try and "speed up" exposure by jabbing the trigger down and then hastily withdrawing the thumb so as not to impede the upward return movement of the trigger. A cursory examination of the shutter will show that this common habit is founded on a fallacy. The best way to expose with a trigger is to place the thumb on the trigger, hook a finger under the camera and "*squeeze.*" The shutter will then be released with little or no vibration.

With reflex cameras the hood makes it necessary to hold the camera at waist level, so that the full-size reflex finder may be seen

Cameras with direct vision finders—of which there are several varieties—are held at eye level

Finders

The finder is a most important fitting and should include the same amount of view as the lens; if it errs in any way, it is better that it should include less than the plate. If it includes more (a wider angle) there is a danger of the user not getting as much picture as he expected.

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CHAPTER VII

THE STAND CAMERA

Filling the Dark Slides

DRY PLATES are commonly used in field cameras, though cut films inserted in sheaths are likely to become popular for dark slides. Dry plates are sold in boxes each containing twelve or six plates, usually the former. A very usual way of opening a box is first to tear off the covering wrapper. This is not always wise, as the box may not be sufficiently light-tight for future use. A better and safer plan is to slit the covering wrapper (not the box) across the centre and then to slip each half of the wrapper from the box. Opened in this way each half may again easily be placed over the box when the whole of the plates are not used.

There are various ways of packing plates, but they are always packed in pairs, sensitive surfaces (film sides) face to face. Some makers issue two plates joined together and folded over face to face ;
film which holds them
must not be torn apart.
continue the movement until the gelatine " hinge " snaps.

All boxes of dry plates must be opened and the dark slides, or sheaths, filled in the safe light of the dark room, but care should be taken not to expose the plates too close or for too long to the ruby light. On examining a plate (or film) in the dark room it will be seen that one side is cream coloured. This is the side covered with the sensitive emulsion, and the side to be exposed in the camera. The plate must, therefore, be placed in the dark slide with the sensitive side facing the draw-out shutter, so as to be facing the lens when in the camera. The sensitive sides of plates should never be touched by the fingers, as they are easily marked and spoiled.

The "Swing Back"

All good cameras for stand work have certain fittings not found in hand cameras There is, for instance, the swing back (Fig 11) shown upright at (A), swung backward at (B) and forward at (C) The use of this back will be fully described in the chapter on architecture

The Extension of the Camera

Many cameras have but a single extension which means that a lens cannot be taken much farther from the focussing screen than its normal 'infinity' focal length Double extension means an extension of about double the length of the baseboard from either the front or the back Light field cameras with tapering bellows usually extend from the front, while the more solidly built cameras with square bellows more often extend from the back Triple extension cameras extend both back and front, and have a separate focussing screen for each section thus enabling the worker to focus either by moving the back of the camera or the front These extensions are of service when copying or using long focus lenses

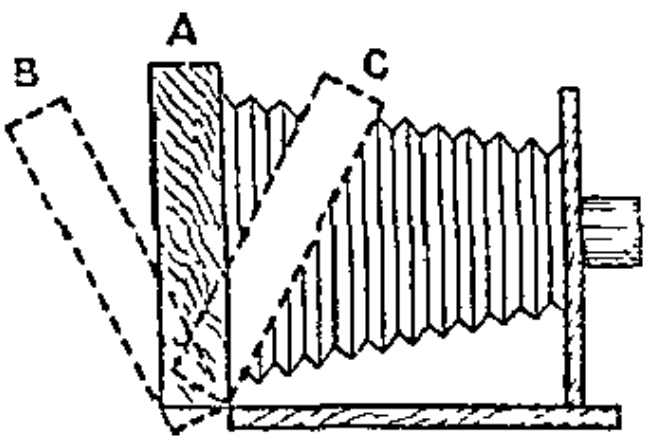


Fig 11

The Rising and Cross Front

There is also the rising and cross front, a most useful fitting found on many good hand cameras By means of sliding panels one is enabled to move the lens upwards, downwards, or to either side without moving the position of the camera It is thus possible to get the upper part of a high building on to the plate, or to decrease the extent of the foreground

Focussing on the Screen

Focussing on a ground glass screen, on which one may see the actual picture the same size as taken, is—or should be—more accurate than focussing by scale, especially in regard to near objects

[illegible]
gra
bla
to receive the lens in one end of the cloth This will prevent the cloth from covering the lens and from being blown off the camera in windy weather If the head is placed under the black cloth and the focussing screen is inspected a more or less blurred image of the view will probably be seen upside-down on the ground glass The picture now requires careful focussing and the lens must be racked either to or from the ground glass till the view is sharply depicted on the screen

When focussing the lens is used at full aperture because as much light as possible is necessary If after focussing the

anything like so bright as with large stops but the outlines will be sharper and objects at the corners of the focuss ng screen which were previously blurred will have become clearly defined (See also Chapter IV)

Making the Exposure

When the correct focus has been obtained remove the focussing screen. The cap having been placed on the lens or the shutter set ready for making the exposure the dark slide should be inserted in the camera but the shutter must not be drawn out until the time of exposure has been calculated

To prevent light from reaching the plate the black cloth should be kept over the camera and the dark slide (but not over the lens) while the shutter of the dark slide is drawn out and during the exposure

The exposure is now made either by releasing the shutter or uncapping the lens

It is essential to mark (by a bit of stamp paper or a chalk mark) the dark slides so that one knows whether a plate has been exposed or not otherwise the mistake of making two exposures on one plate or film is easily made (See also Chapter V)

CHAPTER VIII

THE DARK-ROOM

THE photographer who so wishes may do all the work of producing photographs without a dark room by using roll films developing and fixing them in a "daylight" tank, and printing upon gaslight, self toning or ordinary P O P

Those workers who do not use a tank preferring the dish or visual method of developing, will require a dark room

Red Lamps

A dark room is dark only in a photographic sense A red light is employed to illuminate the room sufficiently to see what one is doing, a red light serving for all ordinary films and plates Only when panchromatic plates (which amateurs very rarely use) are being employed must the dark room be totally and absolutely dark

It must not be thought that the ordinary red (or ruby) light has no effect whatever upon the films and plates commonly used, for it has a decided action if the sensitive surfaces are exposed to it long e
because it acts more slowly
sensitive mediums, and the
exposed to it for longer than is absolutely necessary.

Red glass, paper and fabric are used for covering the lights, but glass is the best A proper "safe light" purchased from a dealer is better than any home-made or makeshift arrangement Common red glass is unsafe because it lets through blue light the eye cannot see the blueness, but the plates and films are affected—and the result is a fogged picture To test the safety of a red light look at a red penny postage stamp illuminated by it If the light is safe no image or reading should be visible upon the stamp it should appear like a piece of white paper seen in a red light

Various Coloured Lamps

For bromide paper and when enlarging a deep yellow or orange light may be used, and most dark room lamps have both colours fitted Many photographers use a deep green light for plates and films but the beginner will find a red light the better Some dark rooms are arranged with red medium placed in a window so that the light of day may be utilized This plan however, is not advisable because daylight not only varies considerably in strength, but is apt to fade the fabric covering the window There are dozens of different patterns of lamps Care should be taken to see that the lamp is well ventilated, we prefer a paraffin lamp with a chimneyless burner and outside wick adjuster, as it is not necessary to open the lamp to control the light

Dark-Rooms

Owing to the presence of ample water, bathrooms and sculleries are often temporarily converted into dark rooms Failing such, the ordinary work of development can usually be carried out quite satisfactorily in any light tight cupboard which allows sufficient elbow room—particularly is this needed when roll films are to be developed uncut In addition to the chemicals dishes and lamp, one need only take in a pail or bowl of water in which to rinse negatives as they pass from bath to bath, the thorough washing which completes most operations can quite well be done in daylight

A point to be borne in mind by all who use temporary dark rooms is that photographic chemicals almost invariably leave nasty stains on tables carpets or other objects on to which they may splash, and it will be found worth while to make a large non leaking tray with a rim at least an inch high on which to carry out all operations A very handy way of keeping necessaries together and out of reach of inquiring fingers is to build a shallow cupboard—say 6 inches deep—about a yard wide and say, 2 feet high The single door should be attached with strong hinges to the foot of the cupboard and should have cord or other supports so that when the cupboard is hung from a wall the door may be opened and will serve as a developing bench, the cupboard being fitted with shelves on which bottles etc., are stored.

It will be superfluous to detail manners of blocking up windows in order to make a dark room. The simplest way

is to make a wooden structure to fit closely into the window frame, and then cover this with canvas and stout brown paper The screen is held in position by turn buttons working on wedge-shaped slips which ensure a tight fit

A useful accomplishment when travelling with a plate or flat film camera is the ability to load and empty dark slides in complete darkness this can be turned to account during daytime by carrying out such operations under the bedclothes or in light proof bags made with sleeves which fit over the wrists in such a way as to leave the hands free.

Desensitizers

The modern amateur may hear a lot about solutions called "desensitizers ' which are introduced to do away with the dark room, or at any rate, to shorten the time of remaining in it, even when dish development is adopted In the usual way of working dish-development one has to stay in the dark room during developing and fixing, but desensitizers enable one very quickly to prepare a plate or film in such a way that development may be carried out in a weak white light and, if necessary, outside a dark room The beginner would do well not to expect too much from desensitizers, and we will consider them when we come to development.

Necessary Chemicals

The kind or quantities of chemicals required for photography depend entirely upon the way in which one works Working in a very simple manner one may produce perfect pictures by using one kind of developer—and that made by dissolving a tabloid or powder in water—and hyposulphite of soda for fixing There are however, those who like a choice of developers, and a supply of chemicals from which they can make up other solutions

The Developer

The beginner would be wise to defer making his own developing solutions, using, at first, either ready made developer solutions or powders or compressed tablets which only need dissolving in water to be made ready for use The chief of these are pyro-soda metol, amidol rytol, hydroquinone and mixtures of the same, e g pyro-metol, metol-hydroquinone, etc , all of which will be dealt with later

Fixing Negatives and Prints

In addition to a developer, hyposulphite of soda—commonly called "hypo"—will be required for fixing negatives and prints Hypo is very cheap and is usually purchased in packets containing 1 lb It is generally sold in the form of crystals and keeps well in a *dry* place, preferably in a covered jar Many photographers keep their hypo dissolved in water ready for use (4 ozs. of hypo crystal in a pint of water), but there is no necessity for doing this as hypo very quickly dissolves in warm water

If an acid fixer is used—and this is advisable for films—a little metabisulphite of potash will be required for adding to the hypo solution

Thus the stock of chemicals required by an amateur is not large, the variety and quantity depending upon the number of solutions he desires to make up "from stock," and the extent of his photographic work or experiments

Those who desire information concerning the chemicals required for intensifying, reducing clearing toning, etc., should see recipes given elsewhere in this volume

Accessories

The essential accessories for the dark room are (*a*) a red lamp, (*b*) two or three dishes for developing and fixing, (*c*) a graduated measuring glass These are indispensable A number of other accessories are very desirable for certain classes of work but as they are optional the amateur's choice will be guided largely by the depth of his pocket Some will afford a tank for the development of plates or films while others will prefer to develop in dishes White porcelain dishes are the best for developing negatives and for toning papers but for fixing negatives black vulcanite dishes are usually preferred, either however may be used Dishes used for hypo solutions should not be used for anything else To begin with three dishes should be sufficient, one the size of the plate or film used, and two twice that size, one for fixing and one for washing, in each of these latter dishes two plates or prints may be worked at the same time Washing and draining racks for plates are also useful and enable plates to be clear of 'hypo' in much less time than when flat dishes are used for the purpose These points, however, will be dealt with when making a negative

CHAPTER IX

DEVELOPING PLATES

[illegible] the plate [illegible] to be developed and fixed

the negative—if properly developed—should be practically the same, no matter what developer or system has been employed.

Developers

Developers differ widely in their composition, their keeping qualities, and their action upon the plate; because of this, we advise the beginner to keep to one solution until he has become thoroughly acquainted with it, for a developer will only give the best results if it is properly used.

The old-fashioned, but still popular, method of developing is in a flat dish, known as the visual method because the point to which development is carried is judged visually (the alternative method—in tanks—is described on p. 52). With dish-development only one plate is dealt with at a time, and normally development is complete in 2 or 3 minutes. With tanks, however, a batch of a dozen plates may be developed simultaneously, but for obvious reasons a weaker developer is used, and although this is a quicker way of developing a large number of plates, the individual times for each plate are much longer.

Dish-Development

In the case of ready-made "Tabloid" or powder developers, instructions for use are issued by the makers. The manufacturers also issue with each box of plates recipes for suitable developers. There are, of course, many developers that will suit any make of plate or film. One of the most popular is

metol-hydroquinone developer (sometimes called "MQ," the Q being a relic of the days when "Hydroquinone" was called *quinol*).

A simple and very good formula is:

METOL-HYDROQUINONE DEVELOPER

Metol	18 grs.
Soda sulphite crystals	1 oz
Hydroquinone	25 grs.
Soda carbonate	½ oz.
Water	20 ozs.

The proper way to mix this developer is to take about 16 ozs. of water, dissolve the chemicals in the order named—metol first, sulphite next, and so on—and then to add water to make 20 ozs. (one pint) in all. The solution is then ready for use and keeps well. It may be used repeatedly, and is excellent for snapshots; for time exposures many photographers consider the solution more effective if 5 grs. of potassium bromide are added.

As to the quantity of developer required it may be noted that 2 ozs. of solution is ample to cover a quarter-plate; 4 ozs. a half-plate.

Before beginning development the fixing solution should be made up by dissolving 4 ozs. of hypo in a pint of water.

Applying the Developer

When all is ready make the room perfectly dark, except for the red light, take the exposed plate and lay it film side upward in the dish in which it is to be developed. Then pour the developer in a gentle and even flow over the plate. If the plate is not covered evenly and quickly the negative will be spoiled by "tide" marks. The flow of the developer must be gentle, so as not to form bubbles; if the latter appear on the plate, break them at once by blowing upon them, or by touching them with a piece of wet cotton-wool. A satisfactory flooding can generally be ensured by tilting the dish slightly and pouring the developer on to the upper end of the plate.

When the plate is evenly covered with the developer, the dish should be covered with a piece of card or similar material, in order that the rays of the red lamp may have the least possible chance of harming the negative. The rocking of the dish should be continued in order that all parts of the

plate may be equally developed The covering card is not absolutely necessary but advisable

After a few minutes' rocking, the plate may be looked at, when perhaps a trace of the image may be seen The white or light parts of the subject—sky, whitewashed walls, white dresses and collars faces—will appear first (black and not white in the negative), then the half tones and finally the shadows The question of how long to develop now arises

How Long to Develop

This is indeed an important question as so many pictures are spoilt by over or under-development The negative is not sufficiently developed when the picture on the surface looks "pretty and nice", development must be continued so as to get density, and it is not density (printing value) we see when looking at the picture as it lies in the dish Density or proper development can be best judged by holding the plate up to the red light and looking through it Another plan is to develop until, on looking at the back (glass side) of the negative, the picture is partly visible This is a matter where experience counts above all else

Over- and Under-Exposure

Should only the dense blacks of the negative appear, and
re, and if little
development,
icture appears
; or two, it is
proof that the plate has been over-exposed With the
metol and hydroquinone developer already named, used at
temperature of about 65° F, a properly exposed plate
of normal rapidity should be developed in from 10 to 15
minutes Very rapid plates require longer development, as
they are slower in gaining density When fully developed
the plate is rinsed for a minute or so in plain water, and
then placed in the fixing bath

Factorial Development

Several methods have been devised for prescribing th
length of time a negative should remain in the develope
The most suitable method for amateurs is that known as th
factorial system The system is based on the fact that th

total time of development has a fixed relationship to the time taken for the first appearance of the image and this rule holds good with certain limits, for all variations of strength of developer, temperature and brands of plates

The "factor" is the number by which the time of appearance is multiplied to give the total time of development, each developer having a different factor or number The factor for the metol hydroquinone developer is 15, and to use it for the factorial development system proceed as follows Place a watch with a seconds hand against the red lamp pour the developer on the plate and rock it, keep a sharp eye upon the seconds hand of the watch and upon the very first appearance of the image, note the time that has elapsed between the pouring on of the developer and the first trace of the image Multiply this by 15 and you will have the correct time for development

The approximate factors for some other developers are Amidol 18, Azol 30, Hydroquinone, 5, Kodak powders, 18 The factor numbers for pyro-soda vary according to the number of grains per ounce of pyro and bromide, and the following are the factors for pyro-soda formulæ as issued by recognized plate-makers Ilford 4½, Imperial 5¾, Barnet, 4¾, Wellington 11

For tabloid developers the normal factors are Rytol, 12, Tancol 12, Amidol, 10, Hydroquinone 4½, Metol, 30, Metol hydroquinone, 12, Pyro-soda, 6 and Pyro-metol 9 Thus if the image appears in 45 seconds with tabloid pyro soda, the total time will be six times this—270 seconds or 4½ minutes

The chief objection to the factorial system is that the plate must be held close to the red light so as to enable the worker to see and note the moment the image appears and in doing this one may fog the plate if it happens to be a rapid one.

Desensitizers

Mention of these must find a place here because they are used mainly for dish developed plates (or films) Desensitizers are dye solutions which cut short the time in a dark room, and allow development to be completed in a weak white light, as from a candle or a gas flame turned low There are two solutions in common use, Desensitol and pinacryptol green the former is a proprietary article, but the latter is not Ten

drops of Desensitol are added to 1 oz of water and the exposed (undeveloped) plate is bathed in the solution for a minute or so, after which development may be proceeded with by the light of a candle The one minute's bathing is done by the usual red light or in total darkness

Pinacryptol green as bought, is a greenish black powder If ½ gramme of it is dissolved in 9 ozs of water it will keep well To prepare for use, add one dram (60 drops) to 9 drams of water This forms the preliminary bath in which the plate or film must be soaked (as in the case of Desensitol) for 1 minute, after which it may be developed by candle-light Either dye may be used for several plates Some workers advocate adding the dye to the developer and bringing the plate into candlelight after about a minute's development by ruby light The separate dye bath is however, better There is no need to wash the desensitized plate after dyeing and before developing

Flat or Cut Films

Flat or cut films, used separately in dark slides or in the form of film packs, may be developed in a dish exactly as plates are developed Most workers, however, prefer the pyro-soda developer for flat films Such films may be de[illegible]

pl[illegible]

in the solution at once, to see that they do not stick together, as the desensitizer cannot then do its work effectively. A good plan is to use the solution in a fairly large dish, keeping the films constantly in motion, and separating those stuck together In this way a dozen films may be desensitized in 2 or 3 minutes for though the time of the operation is given as 1 minute, no harm results from a longer immersion

Air-bells should be watched for as each film is placed into the bath, and any noted should be removed with a piece of cotton wool or a soft brush, otherwise mysterious black patches of fog may appear on the developed negative After being removed from the solution, the films may be placed in a dish of clean water until required, or can be transferred directly from the desensitizer to the developer.

CHAPTER X

DEVELOPING ROLL FILMS

THERE is no difference, chemically, between the development of plates and of films, and all that has been said in previous chapters concerning the dark-room, developers, the appearance of the image, the time of development, the factorial system, and the use of desensitizers, applies equally well to roll films. Plates, however, are made of glass, while films are made of celluloid, and some little differences in working details are needed.

The dishes used for plates will serve, though dishes made specially for roll films have been introduced, but the later and more popular method of tank-development seems to have driven most of the special appliances for the dish-development of films out of use.

Developers for Films

Any developer used for plates will serve equally well for films. The metol-hydroquinone mixture suggested for plates (page 4 [illegible] ro-soda develope[illegible] films professionally. The following two-solution formula can be recommended for both roll films and plates:

PYRO-SODA DEVELOPER

A.	Pyrogallic acid	1 oz
	Soda sulphite crystals	2 ozs
	Citric acid	40 grs.
	Water to	10 ozs.

(When making this do not add the pyro until the soda sulphite and citric acid have quite dissolved.)

B.	Soda carbonate crystals	2 ozs.
	Soda sulphite crystals	2 ozs.
	Water to	20 ozs.

To make up a developer from these two stock solutions, take 1 oz of B (soda solution), 1 dram of A (pyro solution) and 1 oz of water, or, of course, larger quantities in the same proportions

Three Methods of Developing

There are three methods of developing a roll film in a dish, namely (1) cutting up and then developing (2) developing the entire strip until the images appear then cutting the pictures apart and developing further, and (3) completely developing the whole strip

(1) If it is desired to develop the exposures separately the covering paper should be unrolled (in the dark room) until the film appears care being taken to keep the film and paper close together as they were when used in the camera. If the covering paper is held back upwards the printed marks will indicate where the cuts should be made There is however always a danger of the paper winding out faster than the film and when this happens there is a risk of cutting into the pictures When cut up the pieces are placed for a minute or two in plain cold water (to prevent curling) and afterwards developed

(2) Developing until the images appear is safer because the divisions can then be seen The whole strip is developed (see below) and as soon as the pictures are seen they are cut apart placed in cold water, and then further developed until sufficient density has been obtained

(3) Complete development in the length is by far the most satisfactory plan, it was in common use before the coming of developing tanks When a film is to be developed in the full length it must first be separated from the paper wrapping and soaked in clean cold water This should be done very carefully to prevent any sticking because a film only partly wetted is far more sticky and troublesome to handle than when it is wetted thoroughly The simplest and safest method of handling the film is as follows The water is placed in a bowl or dish and the two ends of the film are held in the two hands, or by means of "bull-dog" metal clips the latter being most convenient The film is held sensitive (dull) side upwards, and by being raised in one hand and lowered in the other, the loop is passed through the water backwards and forwards After about a minute,

wh[illegible] ot before
—[illegible] eveloper,
an[illegible]" When placed in the developer the film should be moved to and fro fairly quickly so that the whole film may get its fair share of the solution and so be evenly developed Should the arms begin to ache there is a tendency to limit the movement, whereby the centre of the strip gets the most development.

Varying Exposures

When the exposures vary, some workers may feel inclined to cut up the film and develop more or less according to fancy (as system 2 above), but experience has proved that the best plan is to develop all the exposures for the same time, accepting the medium pictures (presumably correctly exposed) as a guide, and to let the over- and under exposures take their chance

Density is judged exactly as the density of plates is judged, by looking through the film and, if desired, the factorial system (page 46) may be adopted The factor number of the above pyro-soda developer is 10 for some films and 8 for others

It should be perfectly understood that, although we have given a formula for a pyro-soda developer, other developers are equally good for the dish development of films

Whichever developer or system is employed for the dish-development of films the negatives, when dense enough, are rinsed in water and then placed in the hypo solution to fix.

Desensitizing Roll Films

A small piece cut from a roll film may be desensitized in the same way as plates (page 47), but a roll of exposures is a little more difficult to treat, because it is not flat The most satisfactory way is to pass the film through the desensitizer "see-saw" fashion (as when "soaking" it) in order to ensure uniform action, which will not be obtained if the film is allowed to lie coiled up in the solution The film should be passed through the desensitizer for at least three minutes before the action can be regarded as complete, it may then be transferred to the developer in the usual way

CHAPTER XI

TANK-DEVELOPMENT

TANK DEVELOPMENT is a purely mechanical process and the negatives are not seen during development The plates or films are placed in a light tight tank containing a diluted developer and developed for a time that depends mainly upon the strength and temperature of the developer

Advantages of the Tank

It should be understood that there is nothing magical about the tank system for it will not make perfect negatives of wrongly exposed plates or films but it will produce the best results that the wrongly-exposed plates or films are capable of giving The reason why the tank system gives a larger percentage of better negatives than any other method is very simple When the amateur watches development he invariably over develops under exposures and under-develops over exposures.

Makers of tanks and developers have worked out developers times and temperatures for correct exposures and when the tank user does not know whether his exposures are over or under timed he is compelled to develop for the proper time and is not led astray by the quick appearance of the images

Plates and Flat Films

When plates or flat films are to be developed in a tank a dark room of some kind is necessary for a short time because the plates or films have to be taken from the dark slides sheaths or film packs and placed in the tank.

When the plates are in position the lid is placed on the tank which may then be taken into broad daylight The user of roll films needs no dark room He may in daylight place the exposed film in a tank unroll develop fix and wash it

Instructions for Using the Tank

Tanks vary considerably in pattern, size and price, and precise instructions for working one pattern would be useless for another, because of the difference in construction The main difference lies in the manner of inserting and unrolling the film, after which operations the procedure is practically the same for every make All makers issue full instructions

Briefly, the general instructions are as follows The plates or films are placed in the tank, and when the lid is secured the developer is poured into the tank through a light-trapped hole and allowed to act for a given time the tank being rotated or the developer agitated, to secure uniform action When the time of development has elapsed, the developer is poured off through another light trapped hole, and water is admitted

With some tanks only development takes place, the film or plates being removed for fixing and washing, other tanks, however, allow of fixing and washing before the removal of the negatives Brief exposure to white light will not injure a developed, and unfixed film or plate if all the developer has been washed out of it It is therefore most essential to wash a film well if it is to be taken out of the tank for fixing, but if fixing is to be done in the dark tank, thorough washing after development is not so important

Temperature is most important, as it governs the time of development, a thermometer should always be used to take the exact temperature, as guess-work will not do The average time of development for most tank developers is 20 minutes, and the mean temperature at which to use the developer is 65° F Obviously all developers are not at a temperature of 65° F when made up, and the time (20 minutes) is then not suitable, therefore most makers give tables which name the times at varying degrees of temperature

As a rule the time may be taken to vary to the extent of 1 minute per degree—1 minute less for every degree warmer, and 1 minute more for every degree cooler

Developers for Use in Tanks

Generally speaking any normal developer used for dish-development can be diluted for tank work but most workers will prefer to use developers made specially for tanks Very roughly, the necessary duration of development is calculable from the dilution, that is if the temperature remains the

same Thus if a normal developer for dish work will develop in say, 5 minutes, then the addition of an equal amount of water would prolong the action to about 10 minutes, while a three-times dilution would extend to about 18–20 minutes, but these times are quite approximate

Developing powders are in common use a powder being dissolved in the amount of water named by the maker and the film developed for the time stated in the instructions

Pyro soda is a great favourite for tanks and many makers of films and plates recommend it As an example the Imperial formula may be given Stock solution

PYRO SODA DEVELOPER

Metabisulphite of potash	50 grs
Pyrogallic acid	1 oz
Potassium bromide	60 grs
Water (boiled but cold)	12 ozs

This keeps well if made up as follows Begin with 9 ozs of water, add the chemicals in the order given letting each dissolve before adding the next, and finally add more water to make 12 ozs

Next make up two "working solutions" as follows

A	Stock solution (as above)	3 ozs
	Water to	20 ozs
B	Soda sulphite	2 ozs
	Soda carbonate	2 ozs
	Water to	20 ozs

These may be used for dish-development by taking equal parts of each but for tank work take 3 ozs each of A and B, and add 18 ozs of water, making 24 ozs in all. Time of development, 20 minutes at 65° F

A good formula for metol hydroquinone tank developer is

METOL-HYDROQUINONE DEVELOPER

Metol	2 grs
Soda sulphite	100 grs
Hydroquinone	8 grs
Soda carbonate	100 grs
Water	20 ozs

Time of development, 20 minutes at 65° F

With the proprietary developers full particulars for tank work are given with each bottle or packet

CHAPTER XII

FIXING, WASHING AND DRYING NEGATIVES

WHEN developed and rinsed negatives must be fixed in order to be made permanent and in a fit state to be taken into white light and printed from If a developed but unfixed negative is examined it will be seen that there is a large amount of cream colour in it this is unused silver bromide which must come away so as to leave only the developed (blackened) portions The process is called fix ing but it is really a clearing process

For fixing hyposulphate of soda is used There are two kinds of hypo fixing baths in common use the ordinary or plain and the acid

Ordinary Fixing Bath

Hyposulphite of soda	4 ozs
Water to	20 ozs

Acid Fixing Bath

Hyposulphite of soda	4 ozs
Metab sulphite of potash	½ oz
Water to	20 ozs

There are many formulæ for acid fixing baths but the above is the simplest

Ordinary fixing baths will serve quite well for all kinds of negatives but acid baths are to be preferred especially for roll films Ordinary baths very quickly become dis-coloured but acid baths remain quite clear prevent stains and tend to give cleaner negatives

Baths which harden as well as fix are often used in very warm weather The following is a very good formula

Fixing and Hardening Bath

Metabisulphite of potash	1 oz
Chrome alum	35 grs
Hyposulphite of soda	6 ozs
Water to	20 ozs

Dissolve in the order given This bath gives a very hard film but there is no advantage in using it unless the weather is very hot

Time of Fixing

When developed and rinsed the negative is placed in the fixing bath and if the best and cleanest pictures are wanted, the negatives should not be exposed to white light until fixing is complete

Fixing should be continued until all the white or creamy appearance has gone from the negatives and then for an equal period in addition Thus if the whiteness goes in 10 minutes as it probably will the negatives should remain in the fixer for a further 10 minutes. Many may not consider this extra time necessary, but negatives too hastily finished very soon deteriorate.

The dish of hypo should be rocked during fixing Care must be taken to prevent flat or cut films from sticking [illegible] be taken with roll films [illegible] nare of fixing solution. [illegible] nature of long strips of roll film many prefer to cut the pictures apart for fixing and washing and when this is done it is advisable to round off the corners of each negative as the square corners of one film are apt to damage other pictures during the rocking of the dish or when washing is in progress After fixing thorough washing is necessary to get rid of the hypo

Washing Plates

The time necessary to wash negatives depends upon the method adopted The hypo which is to come away from the plates is heavier than water and sinks when it leaves the gelatine film It is therefore not sufficient to lay a negative face upwards in a dish of water Treated in a proper manner a washing of from 20 to 30 minutes is sufficient

Proper washing racks and tanks are useful and cheap

Failing proper washers a good plan is to stand a tumbler upside down in the centre of a bowl or dish and to arrange the negatives leaning against the sides of the bowl or the tumbler As the water can only escape over the top of the bowl and not at the base the receptacle will have to be *emptied occasionally* This plan however, serves equally

well when no running water is available Six separate soakings of about 10 minutes each will rid the negatives of hypo if they are arranged at an angle, film side downwards

Fig 12

Drying Plates

The rack which forms part of the washing tank will also serve for drying the plates but the ordinary folding rack is more common and effective A rough and ready, but very good plan of drying negatives is to place them on a shelf (Fig 13) They should rest at an angle, face downwards, against the wall the lower edge standing upon blotting or corrugated paper A more rapid method of drying negatives is to let down the top half of a window an inch or two, and to rest the negatives (face downwards) at an angle so that the top edges rest against the top pane with the lower edges on the sash of the lower half (Fig 12) where pins will keep the negatives from slipping The draught through the opening will dry a negative very quickly

Washing Films

Broadly, one washes and dries films as one does plates, but the flexible film calls for certain minor alterations in details When a film is washed it should be kept as "uncurled" as possible, and if washed in a dish or bowl, the process is facilitated by the negatives being kept film side downwards in the water or standing on edge so as to allow the hypo to fall from the film

A good method of washing a film quickly is to pin it, face outwards by the two ends to a lath or small plank of wood and to float the wood upside down on a bath of water

Drying Negatives in a Few Minutes

In cases of emergency negatives may be dried in a few minutes To dry a plate rapidly drain it, or with cotton wool wipe away the superfluous water from the film and dry the plain glass side Next place the negative in methylated spirit for about 1 minute Take it out and wipe it with cotton wool, then place it in another bath of fresh spirit for a further 1 minute or so Take it out and again wipe off superfluous spirit, after which if the negative is placed in a warm room in a draught it will dry in a few minutes

To dry films rapidly make a solution of commercial formalin (or formaldehyde) 1 oz, in water 20 ozs Soak the film therein for 10 minutes taking care that the solution acts evenly and well upon the film, then rinse for a minute or two in water and blot off the superfluous moisture The film may then be dried by heat, but if too much heat is applied the film is apt to curl badly Formalin may also be used in the same way, instead of methylated spirit, for plates, but spirit should not be used for films, or in celluloid dishes

The Finished Negative

A perfect negative is difficult to define A negative is perfect if it gives a perfect print, and many negatives which appear to be very poor often give excellent prints No one can really tell the printing value of a negative until a print has been made from it

Generally speaking, the high lights should be dense, if not black, there should be no really clear parts (representing shadows), but good half tone should be present

The best way to judge a negative is to look through it as it is held up to the light, or it may be held over a piece of white paper In both of these tests the negative should appear bright, with all the detail plainly visible Any negative that looks well under these conditions will give a vigorous and quickly printed picture Looking through the negative as it is held up to the sky is a test for density and vigour, holding it over white paper shows the detail and clearness of the negative

CHAPTER XIII

FAULTY NEGATIVES

EXCEPT where the contrary is stated, the remarks below apply to all negatives, whether upon plates or films

Fogging

This is usually caused by stray light getting to the plate If the rebate marks, where the plate or film is covered by a part of the dark slide or camera, are perfectly clear, it is a proof that the fogging was caused in the camera; perhaps the sun shone directly into the lens, or may be the camera is not perfectly light-tight, the shutter may not close properly or the picture may be over-exposed

If the rebate marks are fogged as well as the image, the fogging took place outside the camera; the red light may not be safe, the developer may be wrong, or development may have been forced in order to get as much as possible out of an under exposure. Remedies are obvious

No Picture Appears

If no picture appears, the plate may not have been exposed or it may have been exposed too briefly; in the latter case one usually gets some trace of an image The dark slide shutter may not have been drawn out, or the shutter may have failed to "go off." Another cause of the non appearance of an image is the use of a stale or too cold developer. Always use fresh developer and never colder than 60° F.

Negative Too Dense

This is caused by over-exposure and full development, If over exposure is known or suspected, it is advisable to add a few drops of a 10 per cent solution of potassium bromide to the developer before using it, but this does no good if added after development has started. Bromide "undoes"

excessive exposure Dense negatives may be made thinner and very much improved by being reduced in a solution of hypo and ferricyanide (page 65)

Negatives Too Thin

If all the details are not visible, under exposure is the cause of the defect Should all details be visible but too thin and weak the reason is under development which is the cause of most failures If the negative is not fogged the weak details may be made strong by intensification (page 63)

Negatives too "Contrasty"

Negatives which are too harsh black and white are caused by under exposure and over development Never prolong the development of an under-exposure, you can never get by development details that were missed by too short an exposure Harsh negatives may often be improved somewhat by being reduced with persulphate (page 66)

Uneven Density

Uneven patches of density and wave-like markings are caused by uneven development This defect is due to the operator having omitted to rock the dish rotate the tank or agitate the developer therein, or to his using insufficient developer If the developer is allowed to remain quite still for a time a curious mottled effect may appear on the negatives There is no remedy for these defects but they are easily prevented

Light Streaks Across Negative

These defects are caused by the light getting into dark slide or camera back. Defective winding of the film spool will also cause them, light getting to the imperfectly wound film when it is taken from the camera is another reason for these defects

Stains

These arise from a variety of causes If the negative is evenly stained yellow all over and a pyro developer was used, the defect may be due to the developer being stale or containing too little (or stale) sulphite of soda These yellow stains may be *partly, sometimes wholly,* cleared by the fixed and

washed negative being given a soaking in an acid alum bath (water, 20 ozs ; powdered white alum, 1 oz ; sulphuric acid, 60 drops), and then a good washing *Uneven stains* may be due to parts of the film having remained outside the fixing solution , to insufficient fixing dirty dishes, and to

'ace before fixing

on a negative after it has

are caused by insufficient fixing—the fixing has been long enough for the whiteness to disappear, but not long enough to secure permanency The light acts upon the unseen salts left in the film, and causes the negative to discolour There is no remedy for stains caused in this way.

Silver Stains

Metallic stains are caused by printing from a negative when damp, by using damp paper, or by allowing printing paper to remain too long in contact with the negative in wet weather Should the sensitive paper stick to a negative, never attempt to pull it away or to tear it off ; place the negative, together with the sticking paper, in a fresh hypo fixing bath, and allow the paper to soak off Afterwards wash and dry the negative The hypo will prevent the silver in the paper from staining the film The printed picture, or paper, will be destroyed, but the negative will be saved

Clear Spots

Very small, clear spots in a negative are known as "pin-holes." They are usually caused by dust settling upon the film, and thus preventing the light or the developer from doing its work at these points

paint ; blue is a good colour. By putting on little or much paint to make the spots of the same printing value as the surrounding parts the spots may often be hidden If made too opaque, such spots will print white, in which case the white spots have to be spotted out with a medium the same colour as the print

Black Specks

These sometimes appear on negatives; they are usually due to undissolved particles of the developer settling upon the film Never use a developer until all the chemicals are properly dissolved The spots, which print white, are best *spotted out upon the print*

Halation

This is a light spreading action often found when plates are used, but rarely with films The defect usually appears when very strong contrasts such as a dark roof or tree against a brilliant sky, white trimmings or collar with a black dress,

prevented, by the use of matt-emulsion or self screen plates The defect is caused by the strong light going through the film so that the glass plate bearing the gelatine reflects it

Blurred Images

These may be due to (1) imperfect focussing—in which case the whole negative appears "fuzzy", (2) the shaking of the camera while the exposure is being made—two or more images almost but not quite superimposed will be the sign, (3) movement of the subject during exposure—if this is the case only the subject will be blurred, the remainder of the nega

register of film

an inaccurate

of results similar to (1) above The film may have buckled and not lain flat during exposure

Deposit on Dried Negatives

If a dried negative "sweats," it is proof that all the hypo has not been washed out of it A white powdery deposit on dried negatives may be due to the use of hard, or chalky, water for washing It may be removed more or less completely by giving the negatives a final washing in water made slightly acid In any case, before drying negatives washed in hard water, always wipe off as much moisture as possible, say with cotton wool

CHAPTER XIV

INTENSIFICATION AND REDUCTION

VERY thin negatives are intensified to bring them up to a proper printing density, while very dense or foggy negatives are reduced so as to make them thinner

Intensification

It should be understood that intensification will not *add* details; all it does is to strengthen them

If you wish to intensify a fogged negative, first reduce it so as to clear away the fog, the fog having gone, the details may be intensified

There are several methods of intensification, but only three need be considered here

Mercury Intensification

For mercury intensification two solutions are required

A	Mercury bichloride	1 oz
	Hydrochloric acid	30 drops
	Water (hot)	20 ozs

To mix this powder the mercury salt, which is a poison, and put it with the water into a bottle and shake All may not dissolve but undissolved mercury will do no harm if it is allowed to remain at the bottom of the bottle, when cool add the acid The solution keeps well and may be used repeatedly, until it refuses to work.

B	Liquid ammonia (strongest)	60 drops
	Water	3 ozs

This will not keep, it must be made up as wanted.

To intensify a thin negative either plate or film place it wet or dry in the A (mercury) solution and rock the dish. In a few minutes the negative will begin to bleach, and it

must remain in the solution until the image is quite white all the way through The solution is then returned to the bottle and the dish and bleached negative are well washed

The whitened negative must now be blackened This is done by putting the ammonia solution (B) in a dish into which the negative is then placed and rocked In a few minutes the image will blacken and if all goes well a negative very much improved in density will be the result Finally, the negative is well washed and dried

Chromium Intensification

The method of using the chromium intensifier is similar to that described above The bleacher is best prepared from two stock solutions

A	Potassium bichromate	1 oz
	Water	40 ozs
B	Hydrochloric acid (commercial pure)	2 ozs
	Water	20 ozs

The bleacher is made up in the following proportions

Solution A	4 ozs
Solution B	1 oz
Water	5 ozs

The negative is placed in this solution until thoroughly bleached then washed until the yellow stain is removed and is then carefully redeveloped with any amidol developer

An advantage of the chromium intensifier is that the treatment may be repeated should the first application not give enough density The mercury treatment cannot

Uranium Intensification

The uranium intensifier is made up as follows

A	Potassium ferricyanide	10 grs
	Water	1 oz.
B	Uranium nitrate	10 grs
	Water	1 oz

Mix and add ½ oz of acetic acid This may be used over and over again and keeps well if stored in the dark The thin negative well fixed and washed is immersed in the above until toned to a deep red (the redness is the intensification) it is then washed very gently until all the yellow

stain which accompanies the redness has gone, rapid or too long washing will remove the intensification Dry as usual.

If you like you may remove the intensification by giving the negative a bath of very weak ammonia or carbonate of soda, and then washing it well

All three intensifiers are serviceable for either plates or films, though most workers prefer to use the mercury or the chromium for plates and the uranium for films

Reduction

There are two reducers in common use They have very different actions The ferricyanide reducer acts first upon the shadows and clears away fog, it next reduces the half-tones, and lastly the dense parts It is therefore, of service in reducing and brightening up flat or foggy negatives

The persulphate reducer, on the other hand, first acts upon the dense parts of a negative, and is very slow in reducing fog This reducer is therefore, of value for negatives which are too "contrasty" (black and white)

The Ferricyanide Reducer

To reduce with ferricyanide take a little potassium ferricyanide known also as red prussiate of potash and dissolve it in water The strength of this solution is immaterial, but ½ oz in 2½ ozs of water is a convenient strength Next prepare an ordinary hypo fixing bath (1 oz of hypo in 5 ozs of water), and add a few drops of the ferricyanide solution The colour of the hypo solution when the ferricyanide is added, is a fa[illegible] yellow, straw[illegible] the solution [illegible] reducer will [illegible] much ferricyanide of potassium, and reduction proceeds too rapidly Reduction should be carried on in daylight only, as the negatives require careful watching

As the hypo-ferricyanide solution will not keep when mixed, it must be prepared immediately before use When the solution is ready, pour it into a dish and in it place the negative to be reduced The negative must be very carefully watched and the dish should be rocked to ensure even reduction The negative should be taken out of the solution every few seconds and held up to the light to see how far the

image has been reduced in density The negative must be removed and thoroughly washed directly the density seems sufficiently reduced, in fact, it should generally be taken out before reduction is complete, as the reducer in the film continues acting after the negative is placed in water

The solution only remains active for about 10 minutes after mixing After reduction the negative must be thoroughly washed for 15 minutes

The Persulphate Reducer

The persulphate reducer is useful but is not used so largely as the ferricyanide mixture To prepare it, make up the following just before use

Ammonium persulphate	50 grs
Sulphuric acid	2 drops
Water	4 ozs.

Immerse the fixed and washed negative, preferably before drying, and rock the dish When sufficiently reduced—indeed slightly before—place the negative in a weak soda sulphite solution (24 grs in 1 oz of water) for a few minutes, then wash well. If much reduction has taken place it is advisable, but not necessary, again to fix the negative in a hypo bath afterwards washing it well. Only in cases of excessive contrasts should this reducer be used

Mechanical Reduction

In mechanical reduction, those parts of the negative which are excessively dense are rubbed down with the assistance of either methylated spirit or a mixture known as Baskett's reducer This mixture works more quickly than methylated spirit, but is not so safe in the hands of a beginner

For rubbing down, lay the negative, which must be perfectly dry, on a flat surface. If spirit is employed wet a piece of cotton wool with it and rub the dense parts until they are sufficiently reduced, if the metal polish is used apply with the finger tip or a piece of wash leather Rub cautiously with the Baskett reducer, as it will do more in a minute than spirit will do in half an hour Negatives over reduced by rubbing cannot be remedied

CHAPTER XV

RETOUCHING NEGATIVES

USUALLY the drying of a developed and fixed plate or film will complete the task of making a negative. Many negatives, however, may be improved by intensification or reduction (dealt with in the previous chapter) or by hand-work of some kind.

Spotting

The best of negatives sometimes have spots and small scratches, and these require filling up so that they may not show on the print To the spots and scratches water-colour paint is very carefully applied with a fine camel-hair brush. The paint should be used on the film side of the negative and be as dry as possible. The secret of success is to get the paint as does the negative image. If the paint is too wet it is apt to spread before it dries, and, by going over the edges of the spots, makes the defects even more pronounced when printed.

Working-Up

Working-up is the art of making parts of a negative print lighter or darker than they would if left untouched. The task of increasing lights and shades, or of putting them in where they do not exist, is very simple, but obviously some artistic taste and skill are necessary to make a really good job of it. Plates are easier to work up than films.

Working-up is best done from the plain or glass side of the negative. This calls for no interference with the image-bearing film, but as glass is not easy to work upon, a surface will have to be prepared. Either tissue paper, plain white writing paper, or matt varnish may be used.

A Paper Ground

If paper is used it should have a fine uniform grain and not be mottled, lined, or watermarked, as any markings on the paper will show upon the print The paper should be cut to the size of
by being
minutes,
round its edges on the plain glass side, it must be laid down (plain glass side) on the damp paper, then picked up with it adhering and if need be, the glass and paper should be pressed into contact It is not necessary to stick the whole of the paper to the glass The paper will not be flat and smooth at first, but as it dries it contracts and will become as level and tight as a drum, forming a good surface for working on

Matt-Varnish Surface

Matt
working
made, c
varnish is sold by all photographic dealers This varnish must be flowed not brushed on to the glass side of the negative, and the glass must be quite cold

Lightening

The prepared negative is placed in a retouching desk, matted or paper side towards the worker, and the touches of colour are put on Parts required to print lighter are worked upon with charcoal or lead pencil, while the portions required to print nearly white are worked over with red or yellow paint

Darkening

Parts of a negative may also be made to print darker and shadows can be added or deepened This darkening is done by cutting away the paper, or scraping the matt varnish, from those parts which require to be darkened, slight darkening may be brought about by oiling or greasing the paper or varnish instead of by cutting it away

Coloured varnish is sometimes used with very thin negatives with good effect For colouring the matt varnish a little aurantia or chrysoidine is added, while a more simple plan is to use a little asphalt, which gives a good brown varnish, very easy to scrape away

Retouching

The art of retouching calls for special study and an enormous amount of practice before it can be done properly Portrait negatives are often the better for a little retouching, because the plate or film is apt to exaggerate freckles and wrinkles

The materials required for retouching are lead pencils and a medium Proper "working up" desks are supplied by dealers, but Fig [illegible] erve this purpos [illegible] maller than the [illegible] imilar box, and by fixing it by means of struts (C) at a convenient angle for working upon A strip of wood or two nails (D) below serve as a rest for the negative (E) placed over the hole White paper at the bottom of the box reflects light through the negative

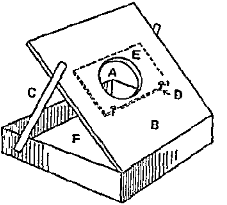


FIG 14

The gelatine film, unless rubbed lightly with a medium will not take a pencil mark The medium is best purchased ready for use, because so little is required, and it is difficult to make up Quite a good makeshift medium for experimental work, however, may be made by dissolving 30 grs of powdered resin in 1 oz of turpentine This is rubbed lightly on the parts to be retouched, and, when dry, gives a "bite" for the pencil

Retouching is an art difficult of acquisition from printed instructions All that can be done here is to give a few practical hints

One of the secrets of successful retouching is to use a lead pencil with a point as sharp as a needle, so as to put on as little lead as will give the required effect, and that in the right place In a portrait, the whole of the face is not pencilled over, but only those parts showing freckles and other defects The pencil marks must not be heavy or clearly defined, and whatever filling in is done must be gradual, so that the lead-

work is built up by hundreds of small dots or very faint marks rather than by a smaller number of heavier strokes Opinions differ as to the best shape of mark to employ

Fig 15

Three strokes are in common use (Fig 15) and beginners should try each of these A mixture of simple dots and comma like strokes (A) serves well for working out or filling in freckles and similar defects a scribbling touch (B) is very suitable for smoothing down too sharp contrasts for the nose and for the forehead where there are wrinkles while cross hatching and short straight marks (C) will be found useful for filling in or lightening up larger patches

Amateurs usually overdo retouching What the worker has to do is shown in Fig 16 where A represents a hole and a mark a freckle and a wrinkle in a negative, these

a

a

(C) and indistinguishable from it on no account must the pencil work go over the edge

Blocking-Out

Blocking out is a method of making skies or other parts of a negative to print quite white and is largely used for pictures of machinery and other objects wanted for catalogues or advertisements Blocking out is done by painting out

lining the objects but large spaces may be filled in with broad washes of colour or by pasting opaque paper upon the back of a negative A good red water colour paint will answer the purpose and has the advantage of being easy to wash off if this becomes desirable

Fig 16

CHAPTER XVI

PRINTING FROM THE NEGATIVE

THE art of photography may be divided roughly into two parts (1) negative making and (2) positive making Positives are obtained from negatives by placing in close contact with the latter sensitive paper On being exposed to light those parts of the paper not shielded by the denser portions of the negative are darkened, and so a positive "print" is produced No chemical or physical change takes place in a negative during or after printing, and thousands of prints may be produced without injuring a negative

There are many varieties of sensitive papers for the production of prints, some for use in daylight, others requiring the aid of artificial light

Although there are so many papers to choose from, the average amateur usually confines himself to two, namely, self-

ment with others and endeavour to produce something different from the "usual thing"

Printing Frames

One or more printing frames, which keep the paper in contact with the negative during its exposure to light, will be required The apparatus consists of a wooden frame with a rebate or bed for the negative and a hinged back consisting of a flat piece of wood divided into two parts and hinged The back is kept pressed against the paper (which lies, sensitive side down, upon the negative) by means of a pair of brass springs The sensitive side of the paper is, of course, placed in contact with the film side of the negative

The back is hinged so that prints made upon self toning and other kinds of printing-out paper (commonly called P O P), may be examined Prints made on gaslight paper have no visible image during exposure and the hinged back is then required only for keeping the paper flat upon the negative

Strength of Light for Printing

For daylight printing on P O P shade is better than direct sunlight and only when negatives are very dense should they be printed in sunlight Printing in the shade takes a longer time but the results are much better The thinner the negative the weaker should be the light for printing, and with very thin negatives, even when printed in the shade it is sometimes advisable to place a piece of tissue paper over the frame so as further to weaken the light Somewhat better results may be obtained by placing a sheet of green glass over a printing frame when making prints from very thin negatives, but the time of printing is very long

Vignetting

This popular style of finishing is usually confined to portrait photography though many people like vignetted landscapes Vignettes it may be explained, are pictures showing the centre clear and distinct and the surrounding parts gradually fading away until the edges are reached, where nothing but the whiteness of the paper is seen

Vignetting is performed during printing , the negatives are

home out of a piece of cardboard To make a vignetter, take a piece of card quite as large as or even larger than the printing frame and cut a hole, smaller than the vignette required, in the centre The edge of the hole should be serrated or scalloped This card is then laid over the frame, and the printing is done very slowly and in the shade

The vignetting card is not placed in close contact with the negative because it is the space between the card helped by the irregular edge of the hole, that gives the softening or fading

the frame it may be necessary to tack or glue strips of wood on the front of the frame so as to increase the space between the card and the negative

The card may be attached to the frame by means of drawing pins No light should reach the negative except through the serrated aperture

Prints made by artificial light are vignetted in a different manner, the short exposure required calling for a movement of the card to prevent any hard outline of the aperture being recorded The [illegible] from the frame and [illegible]le to the negative [illegible] with a circular motion, a soft edge is obtained.

Masks and Discs

Masks are used to give a clean cut or sharply defined, not vignetted white border to a picture, while discs are used to give black or tinted borders Masks and discs (the former are the more common) are cut from thin black paper and various shapes are offered by dealers

Masks for films are usually made from a transparent orange-coloured material

To produce a white border a black mask is placed on the film side of the negative and the sensitive paper is laid upon it, the mask prevents any light from reaching the edges of the negative and a white border results Tinted borders are produced by first making a white margin as described above, the printed portion is then covered with a black disc and a piece of clean glass to keep it flat and in contact The white parts are then exposed until of the required tint The disc used must be that cut from the mask aperture otherwise the matching of the two shapes will be uneven and the border will be ragged If a slightly larger disc is used and can be carefully registered on the print after the white margin has been obtained, an effective white line round the print is produced when the print is again exposed For black borders, a print is made in the usual way All except the border of the print is then covered with a mask and the exposed paper printed

CHAPTER XVII

SELF-TONING PAPER

SELF-TONING paper is the most easily handled of all the daylight printing papers, only a hypo bath being necessary to fix the picture, which is usually of a brown tone

There are over twenty different makes of self toning paper, all alike in the main and differing only in minor working details There are also several varieties, of surface—glossy, matt, semi matt, satin and many others

The paper is sold in cut sizes in packets These may be opened and the paper examined in very weak daylight

When handling this or any other type of sensitive paper care must be taken not to finger the sensitive surface, as finger marks will show plainly on the finished print

Inserting the Paper in the Frame

Having placed the negative, film side upwards in the printing frame, take one of the sensitive sheets and lay it, sensitive side downwards upon the negative then place the frame-back in position, fasten, and print in a shady place

In a few minutes the paper may be examined to see how the picture is progressing To do this unfasten one spring only, lift up one half of the hinged back, and then lift the sensitive paper The closed half of the frame, under the spring pressure, keeps the picture in its place and allows the examined part to fall back again into its correct position

How Long to Print

The depth of printing required depends upon the make of paper used and a few trials may have to be made Some papers require to be more deeply printed than others, but all require to be taken to a darker stage than they are to be when finished because the fixing bath which is to follow, takes away or reduces some of the depth

When printing is judged to be completed the picture is removed from the printing frame, placed in a light tight envelope or box, and another print may be made

Fixing the Print

Instructions for fixing vary slightly, and the beginner should use the strength of hypo bath advocated by the makers As a rule good tones are obtainable by making up a bath containing 10 ozs of water and 2 ozs of hypo, and immersing the printed picture for about 10 minutes, after which it must be well washed for at least half an hour A good brown or sepia toned picture is produced when working as above and the tones may be varied by using stronger or weaker fixing baths or by allowing the prints to remain in the solution for longer than 10 minutes Pictures should never be in the fixer for less than this period

Colours Obtainable

Dark brown to purple tones are obtainable by giving prints a bath of salted water (2 teaspoonfuls of common salt in ½ pint of water) before fixing and colder tones almost blue-black, can be obtained on some papers by using a stronger salt solution

Many makers advise washing the prints in water before fixing in hypo, while others advocate placing the dry picture direct into the fixing solution

One important point in using these papers is that the fixing baths must be distinctly alkaline for if the baths are at all acid, good and permanent tones will not be possible In order to ensure no acid being present (as it sometimes is in cheap hypo) it is a good plan to add a little bi-carbonate of soda, this addition can do no harm

Useful Hints

Use a fresh solution of hypo for each batch of prints Employ deep dishes with plenty of solution and, above all keep the prints moving and separated

Prints when quite dry, may often be improved in tone by being placed between sheets of clean blotting paper, and by being ironed with a hot flat iron

CHAPTER XVIII

TONING AND FIXING "P O P"

P O P (printing out paper) is in many respects similar to self toning paper Prints are made in the same way, but for P O P a special toning bath is necessary The chemicals required to give self toning paper a pleasing tone are embodied in the emulsion with which one side of the paper is coated These ingredients are not included in the P O P emulsion and if the prints are simply fixed the colours are too red Other tones are obtained by first placing the prints in a toning bath, afterwards fixing them (combined toning and fixing baths may also be used)

Gold and Sulphocyanide Solutions

Solutions of gold chloride are commonly used for toning, but since a very little gold goes a long way in toning the expense is not so great as might be imagined Indeed, there is practically no difference between the cost of a finished print on P O P and one on self toning paper

There are dozens of different formulæ for toning baths, but the favourite is a gold and sulphocyanide solution To make this procure 1 oz of ammonium sulphocyanide, and

is done by carefully wrapping the tube in a piece of paper and by breaking the glass, the whole—gold and broken glass—is then placed in a 2-oz bottle and 15 drachms of water is added The gold dissolves very quickly and a yellow

solution is obtained, 1 drachm (60 drops) of which contains 1 gr of gold Thus we have two solutions from which a toning bath may be compounded

To tone four quarter plate prints (or their equivalent in area) the following toning bath would be required

Sulphocyanide solution	½ drm (3 grs)
Gold chloride solution	¼ drm (¼ gr)
Water	2 ozs

Bearing this quantity in mind one is able to make up the exact amount of solution required When making up always add the gold to the sulphocyanide, never the latter to the former

Toning

The prints are first placed in water The effect of this is to produce a milky appearance in the water The prints must be allowed to remain until the water is quite clear They are then placed in the required quantity of toning bath and rocked They will at first turn to a rather unpleasant brown colour, but will soon assume a more pleasing tone The final tone is judged by looking through and not upon them, and one or two trials may be necessary to find the extent of toning desired, because the fixing bath takes away some of the colour given by the toning bath

Fixing

When toned, the pictures are washed for a few minutes and then fixed in a bath made by dissolving 1½ ozs of hypo in 10 ozs of water The prints should remain in the fixer for about 15 minutes and must be kept on the move They are finally washed for about half an hour and then dried

Drying the Prints

After a thorough washing the prints should be placed *face upwards* on a clean cloth or upon good blotting paper, great care being taken to exclude all dust They may also be hung up to dry by means of clips

Combined Baths

It is possible to combine the chemicals for toning and fixing, thus making one bath, but many experts are not in agreement with the plan The tones as a rule are good, but early fading is likely if all does not go well When a

bath tones and fixes at the same time there is a danger of the print being toned before the fixer has had time to do its work hence fading With all combined baths it is advisable to allow the pictures to remain for at least 10 minutes

A Combined Toning and Fixing Solution

For good and permanent results use a combined bath made up on scientific lines The following is reliable

Water	20 ozs
Hypo	4 ozs
Lead nitrate	50 grs
Ammonium sulphocyanide	60 grs
Borax	50 grs
Common salt	4 grs

Hot water should be used and the chemicals must be dissolved in the order given hypo first, next the lead, and so on The mixture is then boiled for 10 minutes and the precipitate filtered out To the clear solution is then added 2½ grs of gold chloride mixed with 2 ozs of boiled water

This bath is the best that can be made, it keeps well if stored in the dark, and gives excellent tones ranging from warm brown to purple Should the desired tone be obtained

after which the prints are dried

Failures

Red or brown patches and streaks are caused by the prints not being moved about sufficiently in the toning bath or by finger marks on the paper

Yellow streaks or patches are due to hypo getting to the prints before or during toning

Pinkness in the whites is due to lack of gold in the toning bath Double tones (two different colours on one print) are due to insufficient toning or to not moving the prints often enough while toning

Too red tones are caused by lack of gold or insufficient toning while slate-coloured prints are due to the use of too much gold or to too long toning

CHAPTER XIX

GASLIGHT PAPER

PRINTS upon gaslight paper are produced by exposing to artificial light with subsequent developing and fixing somewhat on the lines of the production of a negative, but with the advantage that the complete process can be carried out without the necessity for a dark-room

The exposure is made by exposing the paper, in contact with a negative, to a strong artificial light. The print must be handled and developed in a weaker light Gaslight is used, where possible, because it is so easy to regulate the light—full on for printing and low down for developing If electric light is used, the safest plan is to expose to it, and to use candlelight or weak lamplight for developing Some use the light from magnesium wire for exposing, with candlelight for developing, while others use a good paraffin lamp —turned well up for exposing and down for developing

Gaslight paper is sold with a variety of surfaces—glossy, matt, satin, carbon etc , and while some manufacturers make only one grade, the majority issue two, namely, vigorous and soft, each maker giving his product fancy names The "soft" paper is for hard (contrasty) negatives, while the "vigorous"—or whatever it may be called—is for very thin or flat negatives

The Developer

A developer and a fixing solution will be required All makers of gaslight paper give formulæ specially suitable to their products, and it is advisable to use these where possible, though there are some developers that will suit most, if not

papers requiring more than others

The favourite developers for gaslight papers are metol-hydroquinone and amidol, the former is the better as it suits all papers, whereas amidol does not answer well with certain makes Below is a reliable formula for each

METOL HYDROQUINONE DEVELOPER

Metol	15 grs
Soda sulphite crystals	1 oz
Hydroquinone	60 grs
Soda carbonate crystals	1½ ozs
Potassium bromide	2 to 6 grs
Water	20 ozs

Mix in the order named, i e dissolve metol first, sulphite next and so on The developer is ready for use and keeps well in a stoppered bottle Only sufficient bromide should be used to insure clear whites, too little will give foggy prints and too much will give greenish black tones

AMIDOL DEVELOPER

Soda sulphite crystals	1 000 grs
Amidol	100 grs
Potassium bromide	2 to 6 grs
Water	20 ozs

Dissolve the sulphite before adding the amidol and arrange the bromide as required (as with the metol hydroquinone developer described above) The developer is ready for use, and must be used at once as it does not keep

An ordinary fixing bath (hypo, 4 ozs , water, 20 ozs) will serve for gaslight prints, but an acid fixer is better, and the following is recommended Hypo, 4 ozs , potassium metabisulphite, ½ oz , water, 20 ozs

Exposing and Developing the Print

The solutions having been prepared, and the printing frame and negative placed ready, open the packet of paper in a weak (artificial) light and place a piece of the sensitive

is the sensitive side of the paper The sensitive side of glossy, satin and other special papers is easily detected but the sides of matt papers are very much alike One way to tell is to place the sheet of paper upon the open and perfectly dry,

hand, when the sensitive side will curl inwards. Another plan is to bite a corner of the paper between the teeth; the sensitive side will stick lightly to the teeth.

The Exposure

Correct exposure with gaslight paper is necessary for good results, as no developer or method of development will correct wrongly-exposed pictures.

The best plan is to make several exposures, of varying periods, on one sheet, or a strip cut from a sheet. Fill the frame in the usual way and expose in successive sections for increasing periods of time by shielding with a piece of card. For example, place the frame 2 feet from the light and give 30 seconds' exposure; cover a part, say one-quarter, of the negative and give another 30 seconds. Repeat this until the whole negative is covered. The four sections will thus have exposures of ½, 1, 1½ and 2 minutes. The strip is then developed and the exposure ascertained.

When the correct exposure has been found it is most important to keep the frame the same distance from the light because the distance alters the time of exposure to a marked degree. It is easy, however, to calculate the differences. It might be supposed that if 2 feet from the light required half a minute's exposure, at 4 feet the necessary time would be doubled, but this is not so. The intensity of the illumination varies inversely as the square of the distance from the light, which means that at double the distance es the distance our times the distance the exposure would be sixteen times. The same divergent rays of light, at 2 feet from their source, cover four times the surface that they do at only 1 foot from the candle. In other words, the area receives one-fourth the light; the necessary exposure is therefore four times as long.

Developing

When an exposure has been made to a strong light the weaker light for development is made ready. Pour sufficient developer into a clean porcelain dish completely to cover the bottom to the depth of about one-third of an inch. By the side of the dish have some clean water in a dish or bowl, and in a third dish the hypo fixing bath.

Place the exposed print, without any previous wetting, into the developer (or, if preferred, place the paper into a dry dish and flow the developer over it) so that the picture is immediately and completely immersed, then rock the dish

The picture appears almost at once, and development is usually complete in about 30 seconds, but the time varies a little according to the make of paper used Rapid development is desirable with all gaslight papers, since long development leads to stained pictures If the exposure is correct the picture will appear evenly and well and cannot easily be over-developed

Fixing

The developed print should be rinsed for a moment, not more, in the water and then placed in the fixing solution for about 10 minutes, after which it is washed well and dried

Many workers omit the moment's rinse in water and place the developed print direct into the fixer, but it is advisable to rinse off the bulk of the developer No attempt, however, must be made to wash the print at this stage, as one of the

Failures

Marks known as friction marks often appear on finished pictures, they are like—and are often called—"pencil marks" They are caused by something rubbing against the sensitive surface, and may occur when a sheet is pulled from the envelope, or when the paper is being arranged in the frame

The marks may sometimes be rubbed off the dried print with cotton wool soaked with methylated spirit Usually they may be prevented by adding potassium iodide to the developer—20 grs to the pint of the developing solution

Another defect is "freak marks," patches which refuse to develop These give the print a marbled appearance The markings are due to a too weak or too cold developer, also to damp paper The paper is very sensitive to damp, and it is a good plan to war

Gaslight prints, made in th
tone They may, however,
colours (see Chapter XXI).

CHAPTER XX

BROMIDE PAPER

BROMIDE paper was the first of the mediums for printing by artificial light Gaslight paper, which closely resembles bromide, was not invented till many years later Bromide paper is used for contact printing (in a frame) and for enlarging—mainly the latter nowadays, gaslight paper having to some extent displaced it for purely contact work

Bromide is, in many respects, better than gaslight paper Its chief features are its great sensitiveness and its great elasticity in regard to its demands upon the negative

All that we say in this chapter regarding the manipulation of the paper applies both to contact prints and to enlargements, the various arrangements for making the latter being described in a separate chapter

ruby light is required A deep yellow, or a good orange light is quite safe, and these colours are better than red in that they enable the worker to see more easily

All that has been said already concerning the *filling* of the frames, finding the sensitive side of the paper, and making exposures in sections so as to find the correct one (the makers generally issue with each packet of paper a leaflet giving approximate exposure) applies equally well to all bromide papers

Developers for Bromide Paper

All makers of bromide paper give formulæ for developing their products but almost any standard developer will serve Also any developer used for gaslight paper will act with bromide paper if weakened with an equal amount of water, since bromide paper calls for weaker developers and slower development than gaslight paper

In addition to the standard one-solution developers there are those which permit of variations These are made up in several solutions, and certain quantities of each are used to give varying effects One of the best of this type is the following, which is in four solutions, each active ingredient being kept separate

A	Metol	48 grs	C	Soda carbonate	240 grs
	Soda sulphite	1 oz		Water	6 ozs
	Water	6 ozs			
B	Hydroquinone	48 grs	D	Potassium bromide	120 grs
	Soda sulphite	1 oz		Water	2½ ozs
	Water	6 ozs			

From these four solutions developers can be compounded as follows *Normal Developer* A, 2 drms , B, 2 drms ; C, 1 drm , water, 10 drms *For Harsh Negatives (to give soft results)* A, 5 drms , B, 2 drms , C, 3 drms , water, 15 drms *For Weak or Flat Negatives (to give bright and contrasty results)* A, 1 drm ; B, 5 drms , C, 1 drm , D, 20 drops , water, 6 drms

For fixing either the plain hypo bath or the acid hypo bath may be used (page 55) The latter is to be preferred, though it is not so essential as with gaslight papers

Developing the Print

Assuming the contact print or enlargement to have been exposed—both are from this stage onwards treated in the same way—the paper is taken into the yellow light of the dark room for development The exposed paper, on which nothing is visible, is laid face upwards in a clean dish and the developer is poured on If the picture is a large one, say an enlargement of 8 × 6 inches or larger, it is advisable to allow the print to soak for a minute or two in clean water before pouring on the developer, this wetting causes the developer to flow evenly and quickly over the large surface, with small sizes, however, there is no such difficulty

Many prefer to place the developer in the dish and slide th[illegible]

b

[illegible] all goes well the image will soon appear and gradually *gain in strength, the actual time* depending upon the make of paper and the kind of developer used. The image does

not appear as quickly as it does upon gaslight paper A correctly exposed print usually develops in from 2 to 3 minutes, and if correctly exposed, there is no danger of over development, though development prolonged overmuch may lead to fog

Fixing

When the print is fully developed it is rinsed for a minute in water and placed in the fixing bath The amateur will do well to remember that a bromide print—especially one on matt paper—always brightens up in the fixing bath and

be well washed for about 1 hour and then dried

Failures

These are most annoying especially in the case of big enlargements but they may easily be prevented *Blisters*, as a rule are caused by a great difference between the temperatures of the solutions used and of the washing water The placing of prints into a cold hypo solution after a rinse in warmer water will often cause blisters as also will the transference of prints from a cold fixer to a warmer washing water

Always try to have all developing and fixing solutions at the same temperature as the washing water, and never above 65° F Very soft water, too strong hypo solutions, and too rapid washing may also cause blisters

If blisters are particularly troublesome or are feared, they may be prevented by using an alum bath Dissolve 1 oz of white alum in a pint of water, rinse the prints for a minute or so after fixing, not longer or blisters may appear, then place them in the alum bath for 10 minutes, after which they must be well washed Another plan for preventing blisters is to use a fixing bath which hardens at the time of fixing A good formula is

Fixing and Hardening Bath

Hypo	4 oz
Potassium metabisulphite	60 grs
Chrome alum	½ oz.
Water	20 ozs

The hypo and the metabisulphite should be dissolved in 10 ozs of water, the chrome alum in another 10 ozs of water and the solutions then mixed together

White spots are due to the formation of air bubbles during development Should air bubbles appear they should at once be broken by touching with a camel hair brush The spots may be spotted out on the print with indian ink, water-colour or with a lead pencil

Greenish black and bad colours are invariably due to errors in exposure or development, or both Too much bromide will give prints of a poor colour A print of a bad rusty green colour may be improved in tone by immersion in the following bath Water, 5 ozs ; acetate of soda, 20 grs , gold chloride, 1 gr This solution improves the image and tones it black But it is usually better to make a fresh print

It does not pay to intensify or reduce small prints but in the case of very big enlargements it is sometimes more convenient and cheaper to improve a faulty print than to make another exposure

Reducing Density of Enlargements

Enlargements which are too dark may be reduced in tone Make 10 per cent solutions of (A) iodine in alcohol and (B) potassium cyanide in water Take 60 drops of A and 120 drops of B and mix with 4 ozs of water Use this reducing mixture after the usual fixing and washing and wash the print well after reducing

Intensifying Enlargements

To intensify weak bromide enlargements bleach the fixed and washed print in a solution of Copper sulphate, 100 grs , potassium bromide, 100 grs , water, 10 ozs Wash the picture for 5 minutes and redevelop in a solution of , Silver nitrate solution (10 per cent), 100 drops , water, 6 ozs , and wash

Chloro-Bromide Paper

This paper is said to be a paper ' between bromide and gaslight ' It is however, used in the same way as ordinary bromide paper, for although slower in speed an orange or yellow light is necessary for development The developers recommended by the makers should be used The papers give most artistic warm black or brownish black images

CHAPTER XXI

TONING BROMIDE AND GASLIGHT PRINTS

W
black
the b
colour, brown—commonly called sepia—being the favourite and one easy to produce.

The secret of successful toning is to have a good black and white print to work upon. The print must be well developed, properly fixed, and thoroughly washed. Drying is immaterial, but most workers prefer to dry the print before toning it, so as to lessen the risk of blistering.

Amateurs often have to snatch their bromide and gaslight prints hurriedly from the developer in order to prevent them becoming too black; and, while the image in such a case may look pleasing enough at its black stage, it will never tone well. If exposure is accurate there will be no need to hurry the print from the developer, as it will not develop to the too dark stage, even if development is prolonged.

No dark-room is required for any operation of toning; all the work may be done in a white light.

Brown or Sepia Tones

There are several methods of producing these, and many commercial and patented preparations are sold by dealers. The most popular home-made toner is the following:

Solution A.	Potassium ferricyanide	280 grs.
	Potassium bromide	280 grs.
	Water	20 ozs
Solution B.	Soda sulphide	100 grs
	Water	20 ozs.

The A solution will keep well and may be used over and over again until it refuses to work properly, but the B mixture will not keep, it must be made up fresh each time of using Take particular note that sulphide, and not the common sulphite, is used in B

Place the A solution in a dish immerse the black and white picture and rock the dish In a few minutes the picture will bleach and become white or of a light cream colour Keep the bleached print in the solution for a minute or two after all trace of the black picture has disappeared then wash the picture thoroughly—for about 15 minutes at least

Next place some of the B solution in a dish immerse the bleached and washed print, and rock the dish In a minute or two the picture will reappear in a pleasing brown or sepia tone When the print is well 'browned wash it again for about 30 minutes and dry as usual If the picture is too yellow or weak in tone it is a proof that the print was not properly exposed and not fully developed

Another simple brown toning process, and one largely used in the trade for post cards, is the following

Make up the toning bath as follows

Hyposulphite of soda	4 ozs.
Ground white alum	1 oz
Lump sugar	1 oz
Hot water	25 ozs

First, dissolve the hypo in the water, then add the powdered alum, and lastly the sugar The bath should be milky white and must not be filtered The solution should be made up a day or two before being used It keeps well and may be used over and over again, in fact the older the bath the better

This hypo-alum solution will tone in a cold state, but it takes many hours to do the work, and the usual plan is to heat it The most satisfactory method of using it is to place the black and white prints into some of the solution when quite cold (this is merely to harden the film), then transfer them after about 5 minutes' soaking, to another portion of the bath which has been heated to about 130° F In this hot solution the pictures tone very quickly to a good brown colour After toning rinse the prints for a few minutes in a tepid bath composed of alum, 1 oz , and of water 20 ozs , then wash them thoroughly and dry The change from the hot toner to a cold washing water must not be sudden, or

blisters will appear, hence the tepid alum solution Some workers omit the alum solution but let the pictures remain in the hypo-alum solution till it cools

Warm-Black to Red-Chalk Tones

By the copper toning process one can get a range of beautiful tones from warm black to a rich red the warmth of tone increasing as the solution acts upon the print

Solution A	Copper sulphate	30 grs
	Potassium citrate (neutral)	150 grs
	Water	10 ozs
Solution B	Potassium ferricyanide	25 grs
	Potassium citrate (neutral)	150 grs
	Water	10 ozs

Mix together equal parts of A and B immerse the black and white pictures and allow them to remain until they are of the colour required Sometimes the white parts of the pictures turn pinkish If this should happen increase the potassium citrate in either solution When of the tone desired wash the prints for about 20 minutes and dry

Blue Tones

The bath for blue tones also intensifies the picture, prints should therefore be a little weak to get the best result

A blue toning bath consists of

10 per cent	solution of ferric ammonium citrate	1 oz
10 per cent	solution of potassium ferricyanide	1 oz
10 per cent	solution of acetic acid	10 ozs

Immerse the prints until the desired tone is obtained then wash them until the white parts of the picture are clear

Green Tones

Green tones are possible on all makes of bromide and gaslight papers but most photographers who require prints of a green colour use the carbon processes which give the most perfect of colours

There are several ready mixed green toners on the market, formulæ for which are trade secrets, and the amateur is advised to use one of these proprietary products

CHAPTER XXII

OTHER PRINTING PROCESSES

THE most popular of the printing processes—P O P Gaslight and Bromide—having been dealt with brief mention may now be made of other processes It will not be necessary to give full working details of many of them for the simple reason that the majority are owned by firms who supply free booklets giving full instructions

The Platinotype Process

Platinotype is a semi print-out process in which paper coated with sensitive salts of iron and platinum produces on development an image in metallic platinum prints may be black or sepia and are permanent The paper is sold in sealed airtight tins which preserve it from damp its chief enemy and it is the most expensive of all printing papers

The Carbon Process

This is a method of making prints the images of which consist of actual colour pigment and is known also as the Autotype process The prints are produced by the exposure to light of paper coated with a mixture of gelatine and pig ment sensitized with a solution of potassium bichromate the gelatine becomes insoluble where light acts on it and so fixes the pigment Carbon paper—called tissue —as bought consists of paper coated with pigment mixed with gelatine it may be obtained unsensitized or sensitive ready for use (in which condition it does not keep well)

If the tissue is bought ready for use the carbon process is very cheap and easy to work only hot water and alum being required Practically any colour can be obtained The pictures are absolutely permanent and may be trans- ferred to paper wood leather glass or any other support but direct enlargements are not possible

The Carbro Process

This is a very simple process for securing carbon pictures from bromide or gaslight prints Ordinary carbon tissue is soaked in certain chemicals to "sensitize' it, it is then squeegeed into contact with an ordinary bromide or gaslight print and the latter acts upon the carbon paper after the manner of a negative, the chemical nature of the bromide image causing it to print

The Bromoil Process

Bromoil is a "high art" process used largely for exhibition work mainly because of the amount of control it allows

Transferotype and Kerotype

These processes are very much alike A special kind of bromide paper is printed developed, fixed, and washed in the usual way, and the picture thus produced is easily transferred to wood, metal, glass, or any other support

The Ferro-Prussiate Process

Ferro-prussiate is known also as the "blue-print' process It is used largely by architects and engineers for the production of plans, but ordinary negatives can quite successfully be printed upon ferro-prussiate paper Any good paper such as drawing cartridge, or even notepaper may be used Two solutions are required for sensitizing

Solution A	Ferric ammonium citrate (green)	110 grs
	Water	1 oz
Solution B	Potassium ferricyanide	40 grs
	Water	1 oz

Mix equal parts of the solutions together and filter before using, store the combined solution in a dark place

The sheet of paper to be sensitized is pinned to a flat board and the mixture applied with a small clean sponge or a soft brush The coating strokes are made up and down, and then across, this may be done by gaslight or any artificial light, but when coated the paper must be dried in a dark place

The sensitized paper is then placed under a negative and printed in daylight until the image is seen and the shadow portions bronze, the print is then "developed and fixed" by being soaked in one or two changes of plain water

CHAPTER XXIII

SPOTTING, GLAZING AND FINISHING PRINTS

AFTER washing and drying the print may be quite all right for scrap-book or album purposes, but many workers will prefer to spot, glaze, mount or even colour.

Straightening Prints

Dried prints sometimes curl very badly, but they are easily straightened Lay the dried print face downwards on blotting paper or on a flat table, and over the middle of the back of the picture place a straight edge ruler and press it upon the print Next take hold of one corner or edge of the print and draw it slowly under the ruler The latter must be held down firmly, and care must be taken not to pull the print so roughly as to tear it The other half is then pulled under the ruler and the process repeated if necessary

Spotting

Most prints, especially enlargements require a little spotting If the negative has been spotted there are sure to be some white or very light spots that will want working out Ordinary water colour paint applied with a very fine brush is commonly employed, because of the ease with which the colour of the print may be matched and because it may be wiped off with a damp rag if unsatisfactory For bromide enlargements an ordinary lead pencil may sometimes be used

As a rule the best colours for spotting bromide prints are Indian ink and Payne's grey, but for brown toned enlargements burnt sienna, with or without Indian ink according to tone should be used For glazed prints either upon bromide gaslight or self toning paper, it is advisable to add a little gum to the colour A simple way of doing this is to damp the brush, rub it on the gummed flap of an unused envelope then upon the colour desired

Glazing Prints

Most amateurs meet with a lot of trouble when glazing prints All prints do not glaze well, pictures on gelatine papers are the easiest to glaze, and those upon collodion papers the most difficult All bromide and gaslight papers are of the gelatine variety, as are many of the self toning papers, but several of the latter are made of collodion, and for these the usual methods of glazing will not serve

The Glazing Slab

For glazing prints a piece of good plate glass free from scratches, or a sheet of ferrotype tin is required The glass or tin, which we will call the polishing slab, must be quite clean and free from dust Many workers simply clean it with water, and, when dry, polish it with French chalk, but a better plan is to rub the washed and dried slab with a polishing medium made by dissolving 20 grs of beeswax in 1 oz of turpentine, afterwards polishing off with a piece of silk rag A properly prepared surface will save a lot of trouble and disappointment If allowed to dry before glazing, prints require no special treatment, but if glazing is to be done immediately after the usual fixing and washing, it is advisable to harden the pictures for 10 minutes in a solution of formaline, 1 oz , and water, 10 ozs Drying before glazing is said to be the secret of successful work

The Glazing Process

The polished slab is placed in a bowl of clean water, and in the bowl are also placed the dried, or formaline treated prints to be glazed Then while under the water the prints are placed face downwards on the polished side of the glass, which is taken out, with prints adhering, and drained for a minute To do this well requires a little practice, and some beginners will prefer to lay the wet prints upon the wet slab out of the water

The slab with prints, is placed upon a table, backs of prints upwards It is then covered with a piece of clean paper, waxed paper preferred, and the prints are squeegeed well into contact with the glass Air bells, if any, must be squeezed out, and the slab with its prints placed on one side to dry Natural drying is advisable and any attempt to hasten drying will result in failure

When the prints are perfectly dry they will, or should, fall from the slab, and should possess a high glaze. If, however, they fail to fall from the slab, a corner of the print may be lifted with a knife-edge and the picture pulled very gently from its support; a little warming may also help, if the picture is perfectly dry.

Prints sometimes stick to the glass and defy all efforts to get them away whole. When this happens either the water was dirty, or the slab was not clean and properly prepared with a medium. They can sometimes be saved by being soaked off in water. When glazing upon plate-glass it is advisable to employ the same piece as often as possible, as the more it is used the less are prints likely to stick.

Glazing Collodion (Self-toning) Prints

For glazing collodion (self-toning) prints, glazing slabs are prepared by pouring over glass plates a solution made up as follows: Soluble cotton (or gun cotton, or pyroxyline), 50 grs.; alcohol, 4 ozs.; and sulphuric ether, 4 ozs. As soon as the solution has set, the plate is slipped under the prints waiting face down in water. Glass and prints are then withdrawn, squeegeed, dried, and stripped in the same way as gelatine prints.

Encaustic Pastes and Varnishes

Pastes and varnishes are often used for prints on rough papers, particularly enlargements, in order to brighten up the prints, enrich the deep shadows, and to do away with the "dead" appearance some prints have when dry.

Ordinary furniture and floor polishing waxes serve very well. They are applied to the dry print with a piece of rag

ork by most photo-
may be made by
ozs. of linseed oil.

A good print varnish is: Borax, 15 grs.; pale shellac, 30

and water,
l whitening
clear liquid
mounting.

Colouring Prints

The colouring of prints by means of water and oil colours is quite a special branch of work calling for artistic training and skill, but tinting by means of dyes comes well within the scope of the amateur Handy sets of aniline dye colours, complete with full instructions and very easy to use, are sold by all dealers Many of the commercial or packet dyes also may be used if dissolved in water. Blue is the most difficult colour to get and use, but the blues in the sets of colours sold ready for use are usually of a very high quality, and no home-made blues can equal them. The prints require no special treatment before colouring with dyes

The secret of success is to use the colours very much weakened with water, and to get the colour required by building it up, i e making several applications No attempt should be made to get a colour by one or even two brushings—but rather by a dozen or more brushings of a weaker solution. The colours are really stains, so that no colour is washed off or made weaker when a further covering is put on As gelatine prints soak up the colours very greedily the greatest care is required not to put on too much. Matt prints are the easiest to tint, when glossy prints are treated a little gum may be added to the dye if the glaze is affected.

Black and White Finishing

Bromide enlargements to be finished in black and white are given a "tooth" by the application of fine pumice powder with the palm of the hand or with a pad of wash leather Specially prepared "Conte" chalks or crayons are used, also powdered blacklead and charcoal, the selected material is mixed with pumice powder to the shade required and then applied to the print by means of a stump For definite lines sharpened crayons in cedar are used Hard rubber is used for picking out high lights Stumped work may be 'fixed" by steaming the print, which is done by holding the worked-up picture, face downwards, over the steam from a kettle, when dry the work upon the picture cannot be rubbed off

For working up small contact prints Indian ink is used sparingly, and for glossy bromides a few grains of nigrosine black dissolved in 'methylated finish"

CHAPTER XXIV

TRIMMING AND MOUNTING PRINTS

ALTHOUGH printing papers are sold in cut sizes, most prints will be all the better for a little judicious trimming As a rule the larger the picture the more apparent is the need for trimming A small "vest pocket" picture, or the $3\frac{1}{8} \times 2\frac{1}{2}$ size, may look quite well but when enlarged considerably, trimming appears necessary The necessity for trimming prints will be realized when it is borne in mind that few artists of the brush—with liberty to "adjust" the positions of the component parts of a picture—are able to limit themselves to one size and shape of canvas That being so, the photographer—bound to negatives of certain dimensions and to landscapes as planted by nature—has only one means of accurately "filling the space"—by trimming away superfluous portions

What to Trim

When a portion of a print has nothing in it that is interesting or necessary to the balance and composition of the picture it should be cut away A guide to assist one in determining what to retain is shown in Fig 17 Two L shaped pieces of cardboard (A and B) are cut and arranged over a print as shown in the sketch, and by moving these about over the picture one soon finds the portion (C) forming the picture, and (D) the part not really required Occasionally two perfect pictures may be cut from one print

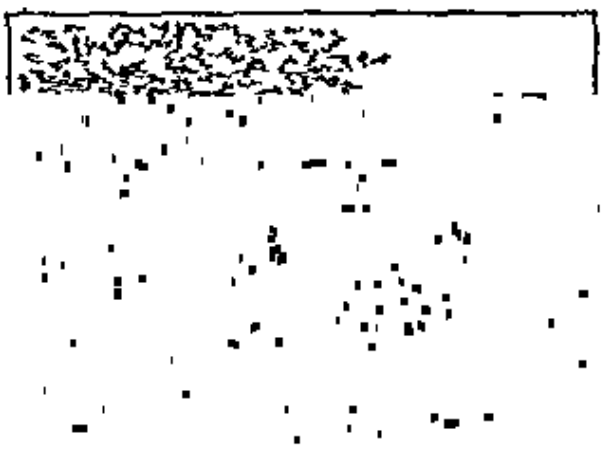


FIG 17

How to Trim

The actual cutting should never be done with scissors, because of the impossibility of getting with them a perfectly straight edge Trimming is best done with one of the many small cutting machines sold by dealers, but it may be done quite well with a sharp penknife, a steel straight-edge to guide the knife, and a sheet of glass, zinc, or a piece of old linoleum to cut upon A T square or set square is handy for getting the corners perfectly square, but a glass plate, say an old negative will do quite well Glass cutting shapes are also sold by dealers, such shapes are of set sizes, but these sizes can be ignored and the glass used only as a guide for the edges and corners

Mounts

When prints are to be mounted separately, mounts that allow the pictures to be very easily placed in position can be obtained The print is merely slipped into the bottom edge of the mount and worked up into position these are known as "slip-in" mounts

Home-made Mounts

Another form of mount—one to which the prints are pasted—is that made up of special mounting papers These mounts are largely used for passe-partout and exhibition work, but they serve for all purposes The papers are stocked in various shades, the most popular being browns, greys, creams, and greens They cost very little and are sold in large sheets, but packets of assorted colours and cut sizes are obtainable By combining the various tints—a process known as multiple mounting—the most effective mounts can be made of any size and to suit any size or shape of print The making of mounts calls for some artistic taste in selecting the colours The tints used should always be "quiet' and harmonize with the print

Mountants

The adhesives in common use for mounting are starch, gelatine and dextrine Ordinary gum and office pastes should never be used for mounting, as they are liable to cause fading The mounting pastes of commerce are usually in the form of a stiff white cream (a dextrine preparation),

but many amateurs prefer to make their own mountants

Starch is easily made but it will not keep A good laundry starch is mixed with a very small proportion of cold water so as to form a very stiff mass It should be so stiff that it is stirred with difficulty Boiling water is then poured in about 12 ozs for every ounce of starch On stirring the mixture should jellify without being boiled but if it does not, it should be brought to the boil cooled and skimmed The paste must be used within a few hours of being made

Dextrine—This is a little difficult to make but it keeps well Place 8 ozs of water in a clean saucepan and heat to 160° F then stir in 5½ ozs of best white dextrine (known also as British gum), keep hot till dissolved then stir in 2 drops of oil of cloves and 2 drops of oil of wintergreen as preservative Pour the paste into wide-mouthed bottles or jars, cork and stand aside for a week When first made this mountant looks like thin treacle but in time it congeals to a firm paste

Gelatine—Gelatine is a useful mountant which keeps well but it has to be heated each time it is required for use To make it soak 2 ozs of best quality gelatine in 8 ozs of cold water, and when swelled dissolve by heating As soon as the gelatine is dissolved, stir in very slowly 2½ ozs of methylated spirit and ½ oz of glycerine Store in a wide-mouthed bottle and before use, melt by standing the bottle in warm water Keep the adhesive warm while using

Methods of Mounting

Any one of the above mountants may be applied with a stiff bristle brush which should be a good one

The method of mounting will depend upon the character of the print [illegible] damping woul [illegible] enlargements [illegible] the easier and more popular method For mounting glazed prints a quick-drying adhesive should be used and there can be nothing quicker than gelatine

To mount by the so called dry method (not to be confused with the heat mounting more usually signified by the term) simply lay the dried and trimmed print face downwards on a piece of newspaper, apply the mountant as thinly as possible taking particular care to "gum" the edges well, and lay the pasted print in its proper position on the mount

Cover it with waxed or blotting-paper, rub down with the hand or squeegee, and put under pressure. Be careful not to use the adhesive too liberally or it will ooze out at the edges.

"Wet" Mounting

To mount by the "wet" process, place the trimmed prints to be mounted in a basin of clean water and after soaking for a minute or two take a sheet of glass and place the prints one by one upon it, face downwards, and one on top of another so as to form a heap, then press and allow them to drain. The adhesive is then applied to the back of the top one, which is afterwards laid upon its mount, pressed down, wiped over with a damp sponge, and finally set aside to dry. The back of the next print in the heap is then coated and treated in the same way, and so on. Care must be taken to wash the sponge after each picture is wiped down.

"Cockling"

To prevent "cockling" use a gelatine mountant as follows: Place a piece of plain glass in warm water, drain and, while warm, coat one side with hot gelatine mountant. Lay the dry print back downwards upon the gelatine glass, rub into complete contact, remove the picture quickly and rub down on its mount or album leaf.

"Dry" Mounting

This is perhaps the best and quickest method of mounting. In this process a thin piece of specially prepared tissue, slightly larger than the print to be mounted, is made to adhere to the back of the print at one or two points by being touched with a warm "fixing-iron."

Next trim the edges of both the tissue and the print—while in contact—and place them in position on the mount. Hold them firmly in position while a corner of the print is lifted and the tissue under it is attached to the mount by being pressed down with the iron. Now cover the print and mount with a thin, flat zinc sheet and place them in the heating press for a few seconds. Heating presses are sold by dealers, but with a little practice an ordinary flat-iron, heated to about 170° F., may be used.

The preparation of the adhesive tissue is a trade secret,

but a serviceable one may be made at home as follows White or pale yellow shellac, 1½ ozs , gum elemi, 66 grs , Canada balsam, 110 grs , and methylated spirit, 5 ozs Divide the spirit into three parts and in each part place one of the other ingredients , when all are dissolved, mix the three solutions together The mixture is painted on one side of the tissue paper and allowed to dry, the other side is then coated in the same way

Fig 18

Passe-Partout Work

Passe partout is the simplest method of mounting and framing or of framing without mounting All that is required is a piece of glass a mounted or unmounted print, a sheet of cardboard as backing, and a strip of paper to bind all together The necessary materials are obtainable from dealers Fig 19 shows a passe partout picture in separated parts, i e the glass, picture and backing card, these are placed together and bound with a narrow strip of binding paper (see section, Fig 18), the paper serving as the frame

If the picture is to be hung up, a ring or tape is placed in the back card This is done by making two slits in the card (before binding it up), passing a piece of tape through a ring and then the ends of the tape through the slits The two ends are then glued or tied on the inside of the card Difficulty is sometimes experienced in getting the binding strip level on the glass side A good way is to get it as level as possible, and then, when dry, to cut it level with a knife and straight-edge, scraping away the crooked parts

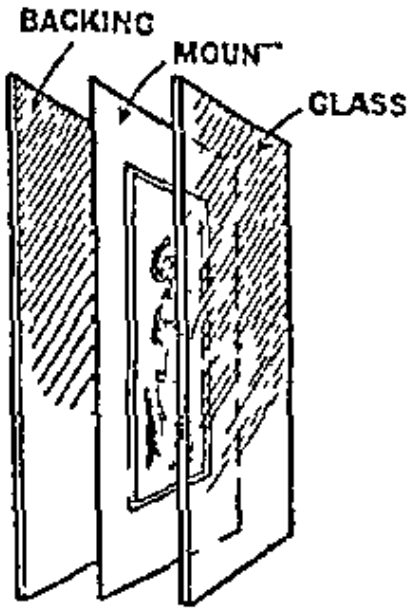


Fig 19

When mounting, both in the ordinary and the passe partout style the picture should never be placed exactly in the centre When the border is of the same width all round the picture appears to be lower than it really is The correct way is to have a trifle more margin of border and mount at the bottom than at the sides and top

CHAPTER XX

LANDSCAPE PHOTOGRAPHY

LANDSCAPE work pure and simple is undoubtedly the easiest and most popular branch of photography Practically any camera and lens, even the cheapest, will serve for landscape work as ve[illegible] tial Ordinary, or slow [illegible] firms issuing special slow [illegible] plate for landscapes in which there is much foliage is the self screen plate, or an orthochromatic plate used with a light yellow screen

Composition of the Picture

Composition and lighting are the main points for consideration, and a knowledge of the rules of composition are a help

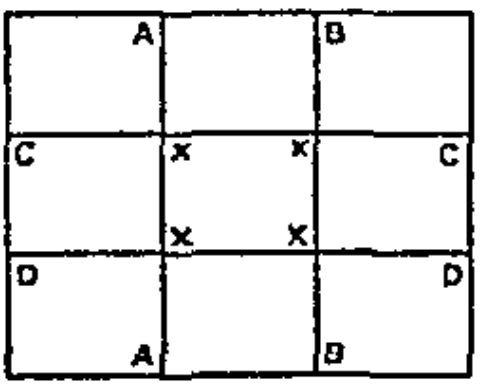
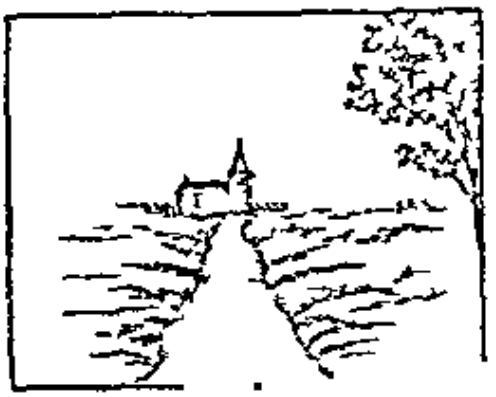


Fig 20

A good method of working is shown in Fig 20, and many workers mark their focussing screens or finders with the four lines (nine equal spaces) shown Assuming the diagram to represent the picture space, then the horizon line should be at or very near either one-third the distance from the top or bottom, i e as C C or D D, while the principal object in the view—building tree or whatever it may be—should be at or near one-third the distance (A A or B B) from either side The four places where the lines cross (X) are said to be the strongest points in a picture

A Few Common Errors

Fig 21 is an imaginary view full of pictorial errors The main object is in the centre which is wrong, the horizon



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line is in the middle, which is also wrong, a "piece" of tree is showing, the road is straight, the foreground lacks interest, and the sky is blank—all errors with which, either singly or collectively the amateur photographer is familiar

line may wind, and always lead into the picture, never out of it Readers with a good knowledge of art and of pictures will know of other rules laid down by artists, but those we have named and illustrated will be quite sufficient for the amateur to keep in mind and work to as far as possible. The use of lenses with differing angles of view and of diverse focal lengths enables views, differing widely as to pictorial effect, to be taken from the same standpoint An uninteresting foreground can thus be eliminated and more distant objects made to take a more prominent position in the picture

Position of the Sun

Fig 22 is a plan showing several different lighting effects, object and camera remaining stationary The sun should never shine upon a view from a point behind the camera (as at A), because in such a position the fewest shadows are seen in the subject and the result is a flat picture with no "life", foliage appears dead and does not stand out boldly as it should, and would with better lighting Amateurs are often told to photograph when the sun is a little to one side (D), i e "over

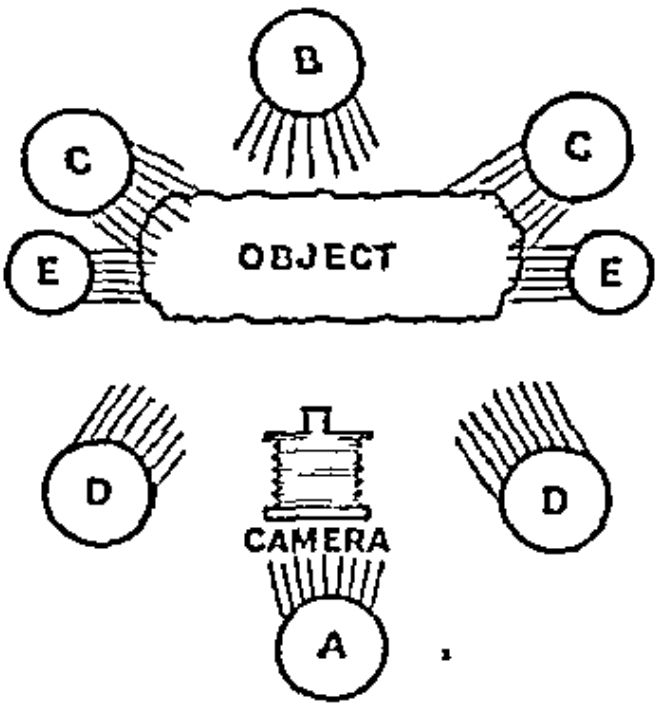

Fig 22

the shoulder", while this is better than having the sun behind the camera, even better results can often be obtained if the sun is more to one side of the object (E), or even a little in front (C) Objects are rarely photographed with the sun immediately opposite the camera, because of the immense amount of shadow presented to the lens, but under certain conditions really effective pictures may be obtained by this method of "front lighting,' but a lens hood must be used As a rule the C or E positions of the sun are the most effective, but care must always be taken to shield the lens from direct sunlight, as the latter shining straight into the lens will produce fogged pictures

Adding Clouds to a Landscape

When photographing a landscape, it is often a difficult matter to secure clouds on the same negative, for the simple reason that under normal conditions the sky requires about one-tenth the exposure necessary for an ordinary landscape; when, therefore, the latter is photographed the sky receives ten times the exposure it should receive, and is thus "lost" (blocked up) during development

Special graduated screens, foreground shutters, and other pro- but not work in the usual way, ignoring the sky (when it prints nearly or quite white) and putting in a cloud from a separate cloud negative

Special negatives of clouds may be made by giving a shorter and correct exposure for the sky and by ignoring the landscape, or by using an orthochromatic plate with a yellow screen on the lens Much depends upon the character of the sky and clouds, but, as a rule, by using a small stop in the lens and giving a very short exposure, effective and serviceable cloud negatives may be obtained on any plate or film

Double Printing for Clouds

Clouds are placed in a landscape picture by a method known as double printing the precise working details depending upon the character of the landscape Assuming we have a landscape with a blank sky into which a cloud is to be

put, a print on P O P. is first made from the negative (but it is not fixed), the landscape part is then cut out with scissors and placed in daylight to blacken The landscape is then printed on a fresh piece of paper, but is not fixed The print is then taken from the frame, and the black mask is placed over the landscape part The print, with the mask, is now put under the cloud negative in a frame, and the sky is allowed to print on the white part representing the sky

When trees, spires, and similar objects obtrude into the sky portion it is not always possible to use a mask, double printing is then done by shading Some workers, however, always shade a print, as they prefer this method to masking

Shading

The landscape negative is placed in a frame with a piece of paper in the usual way, and the frame is placed in a shady place to print Should the sky not print white enough, over the frame is laid a piece of cardboard tilted slightly, and in such a way that the landscape prints while the sky portion is shaded Having obtained, with or without the use of the shading card, a print of the landscape with a white sky, the unfixed print is placed under the cloud negative The clouds are then printed upon the white sky portion, the printed landscape part being shielded by the covering card placed at an angle

This system of shading allows one to "graduate' a sky into a landscape, the card, when properly arranged, softening the join between the two printings

The sky should always be darkest at the top of the picture, gradually becoming lighter as the horizon line is reached. This effect is easily secured by using the card in the manner above described Clouds should always be printed many shades lighter than the landscape, trees and other tall objects in this way can be ignored and the clouds may then be printed over them

CHAPTER XXVI

ARCHITECTURE

THE best architectural work is not possible with a pocket or snapshot camera, for which reason this branch of work is not so extensively practised as it used to be when everybody employed stand cameras. It is, of course, easy enough to take views of buildings, or even interiors, with a hand camera, but for those who make a speciality of architectural work, a stand camera with a rising front and a swing back is essential. A valuable—and for some work indispensable—accessory is a battery of several lenses, having focal lengths greater and less than the normal.

Much, however, depends upon the subject, and there are many things the user of a hand camera may attempt.

When photographing buildings which are to take up the major portion of a picture, it is essential that the film or plate shall be absolutely vertical, no matter how much the camera and lens may be tilted. For this reason an almost indispensable feature of a camera designed for architectural work is—

The "Swing Back"

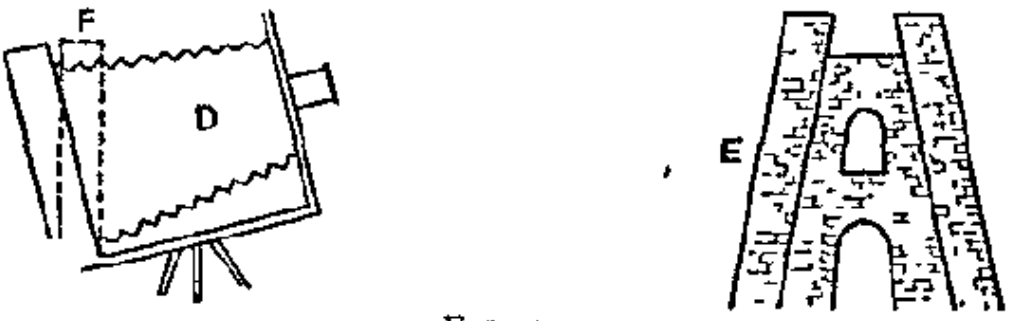

FIG. 23.

or if the camera has no swing back then the upright building would appear distorted in the photograph the lines falling inwards (as E) To photograph the building properly, the back of the tilted camera would have to be swung upright (F) If, on the other hand, the camera is pointed downwards as when photographing from a height the lines of the object would be pictured as falling outwards unless the back were put upright Many architectural subjects necessitate a swing back to ensure undistorted pictures For architectural work it is essential that the camera shall have spirit levels so that there can be no doubt as to the plate being kept vertical

The Rising Front

The rising front is also a great help as it enables the photographer to raise his lens above the normal and so get in more of, say, the top of a building (and less foreground), without tilting the camera Thus for many subjects a rising front is as good as a swing back, though many subjects call for the use of both fittings A rest, made of wood, which can be placed on a smooth and slippery floor, and so prevent the tripod legs from slipping is an invaluable apparatus to those who do much interior work

Exterior Views

Exterior views are, as a rule, not difficult to take Sunlight is to be preferred for most subjects, especially if there is any carving on the building Buildings are rarely pictorial when photographed ' full on," and only architects and builders are likely to admire such views More pictorial results may usually be obtained by taking the subject from an angle

Interior Views

Interiors are among the most difficult of architectural subjects, particularly where poor illumination renders focussing and exposure-estimation difficult No definite rule concerning exposure can be laid down, interiors differing so widely A domestic interior may under favourable conditions need but a minute s exposure, whereas the exposure for a dimly lit church may run into several hours By the use of an exposure meter, an estimation of the value of the

ught is obtained by noting the time taken to discolour a
strip of sensitive paper. Small stops in the lens are used
because of the ma
and on account of
at one time, altho
the salient features are sharply focussed, objects of secondary *interest being reproduced less distinctly and serving to set off the objects of prime interest*

Focussing

Many methods of focussing in dark interiors have been advocated The largest stop should always be used when focussing and, where possible, it is a good plan to focus a lighted match, candle, or taper The focussing of a bright window is also a help, but when a window is focussed the other parts, particularly near ones, may not be in focus, unless of course a very small stop is used, thus prolonging the exposure very considerably

The most scientific method of focussing—if one has the time and convenience for carrying it out—is to focus the camera outside the building in a good light and to work as nearly as possible to the following table which shows the distance at which the best focus should be obtained

Most Distant Object (in Feet)	Nearest Object (in Feet)					
	5	10	20	40	60	100
10	6½					
20	8	13				
40	9	16	27			
60	9¼	17	30	48		
100	9½	18	33	57	75	
150	9¾	18¼	35½	63	86	120
200	9¾	19	36½	66	92	133
300	10	19½	37	70	100	150

Suppose the nearest object of importance (e g a pillar or font) in a church interior to be 20 feet away from the camera, and that the most distant object is a window or altar some 150 feet away, then the best point on which to focus, with the largest stop, is 35½ feet distant from the lens The camera

can be focussed out of doors on something 35½ feet away, the focussing clamped, and stops adjusted until an object 20 feet away is clear on the screen, when the most distant object (150 feet) will also be clear Thus, we find the focus and stop required for the dark interior The camera can then be fixed up in the interior and the exposure made The focussing must not, of course, be altered, but the stop may be temporarily altered so that the view may be arranged on the screen Care must be taken, however, to readjust the stop before exposing as it is the stop that ' pulls ' the 20 feet and 150 feet distances into focus This plan is better than the common one of focussing a distant window and inserting smaller stops until the nearest point is in focus, because it permits of a larger stop being used, and consequently a shorter exposure

Halation

Halation is a defect often met with when making negatives of interiors It takes the form of a fringe of fog that appears around any bright object when photographed against a dark one It is especially noticeable round windows (interior views), but the defect is often met with in exterior subjects where dark roofs or trees come sharply up against a very bright sky

The defect is easily explained and prevented It is caused by [illegible] he film, through whi [illegible] where they are refl[illegible] a fringe of fog round the edge of the image results The thinner the film of sensitive emulsion, the thicker the glass and the brighter the light (in contrast with the adjoining darkness) the more likely is halation to appear

The Prevention of Halation

Ordinary plates are prone to halation, but matt emulsion and self screen plates are much less liable to the trouble, because the emulsions employed are more nearly opaque Halation, however, may be minimized by " backing ' This consists of placing something on the back (plain glass side) of the plate to destroy its power of reflection

" Backed plates cost but a few pence more than the unbacked variety

CHAPTER XXVII

PORTRAITURE

PORTRAITURE—if it is to be really successful—calls for *more care and thought than almost any other branch* of photography.

Suitable Cameras

Practically any camera and lens may be used for portraiture. Additional lenses—called portrait attachments—make good portraiture possible, even with pocket cameras. To secure the very best results, however—especially indoors—a focussing camera, on a tripod, and a lens of a fairly large aperture should be used. In any case, it is desirable always to use the largest possible aperture consistent with the degree of definition required. A common fault with amateurs is the desire for a large image to fill the negative. This frequently leads to results far less happy than well-defined small images, which yield excellent enlargements.

Posing and Lighting

Posing and lighting—particularly the latter—are the main points in portraitwork, and they need some consideration if the best results are desired. Amateur portraits usually lack life and roundness, the familiar flat-lighted results being anything but pleasing. The *methods of lighting for in*door work differ greatly from those necessary for outdoor work.

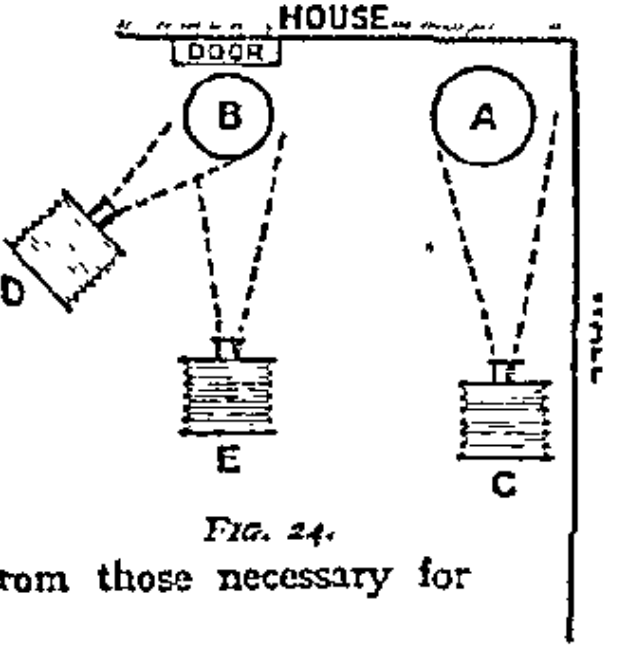

Fig. 24.

Outdoor Lighting

Portraits taken out of doors are often failures because the illumination is too general and, more frequently, because the sitter is placed in the full glare of the sun, this latter in addition to "screwed up" features destroys roundness and gives the face too white an appearance In all good portraits one side of the face is rendered darker than the other, and to get this effect the lighting must be controlled

Positions of Subject and Camera

Assuming Fig 24 to represent a garden with a house and wall as shown the beginner would, in all probability, place his subject at the door B and his camera immediately opposite E While quite a pleasing portrait might be obtained in this way, a better one would be secured by placing the camera more to one side D

Seen from E a face at B would be flatly lighted, because the light would reach it from both sides in equal quantities, whereas, seen from D, the house might serve to give the necessary shadow Another good portrait might be taken if the sitter were at A and the camera at B or C Too much

the sitter The main idea is to prevent too much uncontrolled light from reaching the face of the sitter, without "over shading"

A Common Defect

In hand camera portraits the faces frequently become too dark, this defect is always met with when the sky is made to serve as a background A secret of success when taking snapshot portraits is always to pose the sitter against something darker than the face, say foliage, rocks, or a wall, as only when the actual face is the lightest part will it appear light in the photograph

Portraits should never be taken in direct sunlight, always in diffused light or in the shade

Indoor Lighting

If one has a suitable window which can be arranged to give effective lighting, far better portraits can be taken

indoors than in the open air. It is usual to recommend a north light for portraiture, that is to say a window with a northern outlook; this, however, is merely to ensure that the sun does not shine directly into the window. Provided that the direct rays of the sun do not enter it, any window will serve equally well for average portraits.

Fig. 25 is a plan showing the conditions necessary for indoor portraiture. The window should be a fairly large one, and against it should be placed the sitter (A). A reflector will be required for the shadow side of the face; for this a white sheet on a screen or clothes-horse serves very well and far better than a mirror, which does not sufficiently diffuse the light.

By altering the positions of the sitter, reflector, and the camera, practically any scheme of lighting may be secured.

Much depends upon the window, and, as a rule, muslin or lace curtains are best left in position, as they serve to diffuse the light. The best lighting may be obtained by covering the lower half of the window with white tissue paper, and placing the sitter in such a position that the light from the uncovered part of the window reaches the subject at about an angle of 45°. Should a pull-down blind be fitted, the incoming light may be regulated almost as well as may be done in a well-equipped studio.

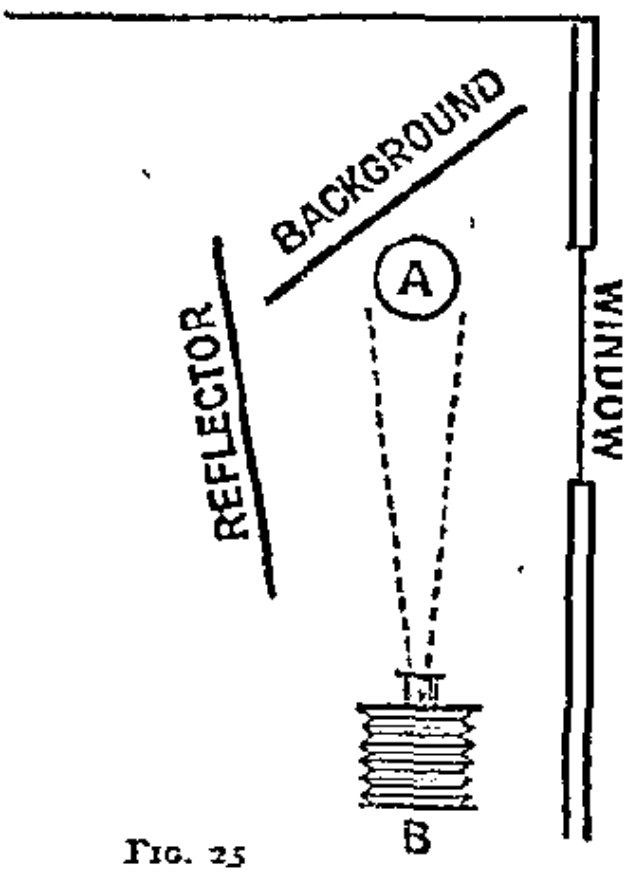

FIG. 25

Backgrounds

For head and shoulder work, particularly indoors, a plain or shaded background, preferably of a slate colour of a medium tint, is useful. By using this at an angle facing the light (Fig. 25) it may be made to photograph quite light in tone, or darker if turned from the light, with

photograph too plainly, it must be placed a good distance behind the sitter and not in too strong a light

In outdoor work where natural backgrounds are employed, it is important not to focus them too sharply A rock or but a brick as the lights e quiet" and never so pronounced as to take the attention from the figure

Posing

Poses should be easy and natural, not strained or artificial

As regards a head and shoulders portrait, a full face is rarely pleasing A 'three quarter" face is much better, but only persons with really good, well shaped nose and chin should be taken in absolute profile Whatever the pose of the head, the eyes should, as a rule, look in the direction in which the nose is pointing, and care should be taken to have the best side of the face nearest the camera, for one side of every person's face is always more attractive than the other, usually the (sitter's) right side is the better. The head should be on a level with the camera, rather above than below it, as "looking down" views shorten the neck and make the sitter appear "squat," the head appearing to sink into the shoulders

When posing full and three-quarter lengths it is well to pay particular attention to the head, as by a subsequent enlargement, one may, if desired, secure a good head and-shoulders portrait of any size.

Group Work

In group work one has not the same scope for posing and lighting, and special care should be given to the arrangement of the figures Groups are best taken where there is not excessive top light, which darkens the eye sockets, and the arrangement of the figures should not be too symmetrical, or, in other words, "all in a row"

CHAPTER XXVIII

LANTERN SLIDES AND COLOUR PHOTOGRAPHY

LANTERN SLIDES are made by printing from the negative upon glass plates A transparency which can be shown in the lantern is thus produced, and the work is little or no more difficult than making prints upon paper Lantern slides are simply glass plates, measuring 3¼ inches square, prepared with sensitive emulsion like that used upon bromide and gaslight papers, they are exposed, developed, fixed and washed in exactly the same way as a print made upon paper. The size named is a standard one, all full size projection lanterns taking this slide, though the actual picture upon it may be, and usually is, of a smaller size

There are many varieties of lantern plates, for although some have emulsions exactly the same as those upon bromide and gaslight papers others have special emulsions which give a wider range of tones than can be obtained upon paper, and developers can be used for pictures upon glass which cannot be used for paper prints, because the developers would stain the papers Pyro for example, would stain a paper picture, but it cannot stain glass, and one may obtain with it lantern slides of very pleasing brown tones and exceptional richness

Slides are made by contact and by reduction by contact when the picture on the negative will go within the 3¼ inch slide, and by reduction (in size) when the negative picture is larger than the lantern plate

As lantern plates are prepared in the same way as bromide and gaslight papers, all that has been said about such papers in previous chapters applies equally well to lantern slides The lantern plate is simply placed in contact with the negative in a frame, exposed, developed, etc, as the paper with a similar sensitive coating would be, ordinary or special developers being used as desired

Mounting and Finishing

The dried lantern plate with its picture has to be masked and bound to a cover glass in order to protect the film from damage It is necessary also to finish the slide in such a way that any lanternist may be able to distinguish the right from the wrong side for being a transparency it may be viewed from either side of the glass support As trimming is not possible, as with prints masks of black paper are used to block out parts of the picture not required Suitable masks 3¼ inches square which have apertures of various shapes and sizes are sold by dealers, though many workers prefer to use strips of black paper that can be pasted upon.

When properly masked to show the amount of picture required the picture side is covered with a piece of plain glass the exact size of the lantern plate, and the two plates are bound together at the edges with a binding strip Two circular white spots at the top corners of the picture tell the lanternist who handles the slides in semi-darkness, which is the right side and top of the picture

Titles are usually written in white ink upon the black masking paper, or upon the binding strip

COLOUR PHOTOGRAPHY

For many years experimenters have been busy with processes of colour photography Several methods have been introduced but most of them have been much too expensive and far too difficult for the average photographer to work. A really cheap and simple process of producing photographs in natural colours upon paper is yet to be evolved but there are two very good and fairly easy methods of producing colour transparencies upon glass These may be used as lantern slides or for window decoration

The Autochrome Process

In the Autochrome process a special plate is used the colour being in the plate, which is made by covering glass with minute starch grains dyed blue, green and red, the grains are so small that they cannot be distinguished by the naked eye, each colour is dyed separately, they are then mixed in proper proportions, and peppered' upon the glass Over this coloured layer or screen is co[illegible]

gelatine emulsion. Thus the Autochrome plate is a dry plate with a screen of coloured translucent particles between the film and the glass. This plate is placed in the camera glass side towards the lens, so that the image of the coloured object photographed passes through the colours and is reproduced on the film, the light rays acting little or much upon the film according to their colours. After the exposure the plate is developed (not fixed) and an ordinary negative image is the result; the lights and shades are then reversed in a special solution. The makers of the plates give full directions for their exposure and development; further instructions are therefore unnecessary here.

It will be understood that there is no negative, the exposed plate makes the finished picture.

The Paget Process

The Paget process is also based on the colour-making qualities of blue, red, and green, but the colours are not in the plate as they are in the Autochrome. A glass plate, called a "taking screen," which is covered over with thousands of minute squares of colour, all in perfectly regular order, is used. This screen is placed in contact with a dry plate, being placed in front of the plate in the camera so that (as is the case of the Autochrome) the rays of light may go through the screen before they can be recorded on the plate; the colours act in the same way as with the Autochrome.

After exposure in the camera, the screen and the plate are separated, the coloured screen (which may be used over and over again for any number of exposures) is put aside and the negative is developed and fixed as usual. A lantern slide or other transparency is now made from the negative. This is developed, fixed, washed, and dried as usual. The dried

By careful adjustment the operator can place the coloured screen over the black and white transparency in such a way that the colours fit over the parts necessary to produce a correctly-coloured photograph. An advantage of the Paget process is that when once the colour key negative has been obtained, any amount of transparencies may be printed from it, and each bound up with a viewing screen

CHAPTER XXIX

COPYING

FOR copying photographs prints, drawings or paintings a camera having a double or triple extension is a convenience for it is not easy to copy well with an ordinary single extension camera, though by using a supplementary lens the latter camera may sometimes serve the purpose

To copy the same size it is necessary for the lens to be double its normal distance from the plate (or film) and exactly midway between the picture copied and the plate

Most copies made, however, are of a reduced size, many workers preferring to make the copy, no matter what the proportion of the original may be, the size of the negative taken by the camera, but, even in copying to a reduced size, camera extension is important, though it need not be double

Calculating Distances between Object, Lens and Plate

The rule for finding distances of lens from plate, and original from lens, is very simple First decide upon the amount of reduction required, i e the number of "times", then to find the distance from lens to original, multiply the focal length of the lens by the amount (number of times) of reduction and add the focal length thereto To find the extension, divide the focal length of the lens by the number of times of reduction and add the focal length to it

This is not so difficult as it appears to be, but the final adjustment will have to be brought about by careful focussing

Many prefer to ignore calculations tables etc, and to find size and distances by experimenting

Securing Increased Focal Length

Most single-extension cameras will copy to only a very much reduced size because the "spare" between the lens at normal focus and the end of the baseboard does not allow

of much variation of focal length By fitting a suitable supplementary lens to the front of the camera lens the focal length of the camera lens is shortened and the necessary extension can often be secured Portrait attachments act in the same way and may often be used

Enlargement by copying is possible if the camera has a lens of short focal length and a very long extension

Copying with a Fixed-Focus Camera

With cameras of the "fixed focus" type, extension is, of course, not possible, but the objection can be overcome by the aid of a supplementary lens such lenses are often called magnifiers The particular focal length of this additional lens must be equivalent to the distance of the camera lens from the object to be photographed, and then with the assistance of a fairly small stop, a satisfactory result will be possible

Lighting

When copying, it is absolutely necessary to have the camera exactly square with the picture, and this is not easily accomplished when the camera is used upon a tripod The arrangement is more easy if the camera and the picture to be reproduced are placed on a table Copying should be d [illegible] If copied ir [illegible] window, a [illegible] and the grain of the paper is apt to show in an uneven light

The lighting of the original is the most important part of the work, and the photographer must alter the position of [illegible]

definition small stops should be used when copying

Exposures for Copying

Exposures for copying are best found by trial, as they depend not only upon the light and speed of plate, but also [illegible] y as when the lens [illegible] the normal distance [illegible] for example, when used for copying same size, is only F 16

CHAPTER XXX

ENLARGING

THE popularity of the hand camera has led to the production every year of thousands, it might almost be [illegible] ...iese are capable [illegible] ...loreover, there [illegible] ... with a pocket camera and subsequently enlarged, but which cannot be taken direct on large plates There is however, a limit to size, as the average negative does not enlarge well to more than about 3½ times its linear dimensions

The principle of the enlarging apparatus is similar to that of the magic lantern, but the picture (negative) to be enlarged is cast upon a piece of sensitive paper instead of a screen, the paper being developed and fixed in the same way as a contact print upon bromide paper.

The Enlarger

Fig 26 illustrates the principle of enlarging, no matter what kind of lantern or camera is used for the work. The window is blocked up and made absolutely light-tight, except for an aperture the exact size and shape of the negative from which the enlargement is to be made A reflector at an angle of about 45° to the [illegible]

negative (in the camera in the position usually occupied by the plate), and then through the camera lens, which should be of the same focal length, approximately, as the lens used in making the negative

The sensitive paper is pinned to an upright board or box, which can be placed at any desired distance from the lens

and always perpendicular to its axis (at 90° to the table top) By focussing and by moving the box nearer to or farther from the lens a sharply defined image of the right size is thrown on to a piece of *ordinary* white paper the same size as the sensitive paper to be exposed. The red or yellow glass

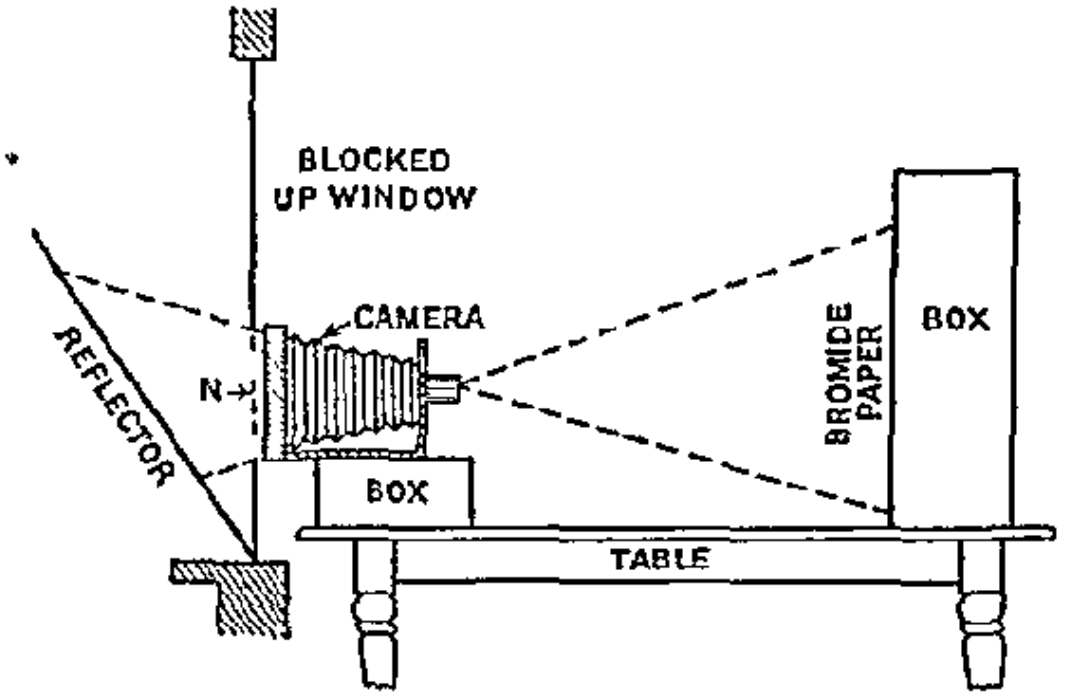

FIG 26

cap is put on the lens the bromide paper substituted for the ordinary plain sheet of paper, and the correct exposure given

A Simple Daylight Enlarger

A cheap and simple form of enlarging camera for daylight work is the fixed focus pattern The apparatus consists of a box in which the negative is placed at one end and the sensitive paper at the opposite end A lens with a medium aperture and a shutter for making the exposures is placed between them The lens fixed focus casts an enlarged picture upon the paper The enlarger is loaded in the dark-room, taken out into daylight where the negative end is pointed to the sky The exposure is then made by opening and closing the shutter, after which the enlarger is taken into the dark room where the paper is taken out and developed. Enlargers of this pattern will, of course, only enlarge to a fixed degree Many forms of enlarger are available

Artificial-Light Enlargers

There are scores of patterns of enlargers for use with all kinds of artificial light—oil, gas, or electric

Focussing trial exposures, development, etc, are as for enlargements made by daylight, and the instructions which follow will serve for either method of enlarging

Size of Enlargement

As already stated, the size of the enlargement depends upon the focal length of the lens used and the distances between lens and paper, and lens and negative, but very big enlargements from small negatives are likely to lose in quality As a rule it is not advisable, unless the negative is a particularly good one and full of detail, to enlarge a quarter-plate to a larger size than 12 × 10 inches, and other sizes of negatives in the same proportion The accompanying table (based on a larger one which appears annually in the *British Journal Photographic Almanac*) gives the distances for linear enlargement, i e 3 inches to 12 inches = an enlargement of four times

DISTANCES WHEN ENLARGING

Focal length of Lens inches.	Times of Enlargement.							
	1	2	3	4	5	6	7	8
3	inches. 6 6	inches 9 4½	inches. 12 4	inches. 15 3¾	inches 18 3⅗	inches. 21 3½	inches. 24 3⅜	inches. 27 3⅜
4	8 8	12 6	16 5⅓	20 5	24 4⅘	28 4⅔	32 4⅝	36 4½
5	10 10	15 7½	20 6⅔	25 6¼	30 6	35 5⅚	40 5⅞	45 5⅝
6	12 12	18 9	24 8	30 7½	36 7⅕	42 7	48 6⅞	54 6¾

The table is used as follows —Knowing the focal length of the lens to be used and the degree of (linear) enlargement look up the figure for enlargement in the upper horizontal row and carry the eye down the column below it until it reaches the horizontal line of figures opposite the focal length of lens in the left hand column

When enlarging the greater of the two distances where the two lines join is the distance from lens to the sensitive paper or plate The lesser is the distance from lens to negative or picture being enlarged direct in camera

Trial Exposures

Exposures for enlargements depend upon (1) Strength of light, (2) Density of negative, (3) Size of enlargement, (4) Size of stop used in lens, and (5) Speed of bromide paper

The best way of finding the correct exposure is by trial, as follows Having, by adjustment of the reflector or the artificial illuminant, ensured that a bright, even light is thrown on the easel, place the negative (upside down and film side nearest the paper) in position, and get a sharply defined image of the right size, by adjusting the relative positions of the easel lens and negative, upon a piece of white paper pinned to the easel or box The largest stop should be used during focussing, once this operation is completed, however, finer definition (in the daylight method) will be [illegible] be remembered that [illegible] ze of stop used, the [illegible] It is advantageous to have a hole, about 1 inch in diameter, in the centre of the easel When focussing, a ground glass may be placed over this hole and by looking through from behind the easel, the operator may easily decide on the sharpest focus Now put the yellow cap on the enlarger lens, and arrange the dark room lamp for handling the sensitive paper In most packets of very large sheets of bromide paper there are to be found several small pieces for making trial exposures upon, if not, a long narrow strip may be cut from one of the sheets, as it is by no means necessary to use a whole sheet for trial exposures Pin the narrow strip, or one of the small trial pieces, upon the easel in such a position as to embrace portions of the light and shade of the picture Shade three parts of the paper with a card, uncap the lens, [illegible] making a note of all the exposures given to the sections, then develop the strip, and the best result will indicate the correctly exposed portion It may, of course, be necessary to expose another strip before the right exposure can be found.

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Use

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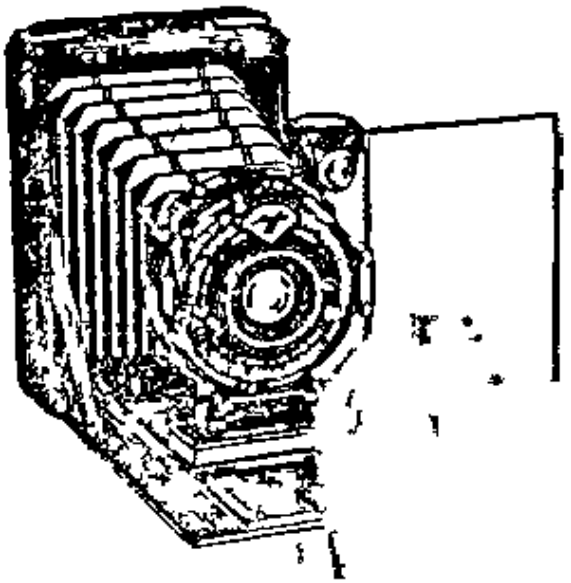

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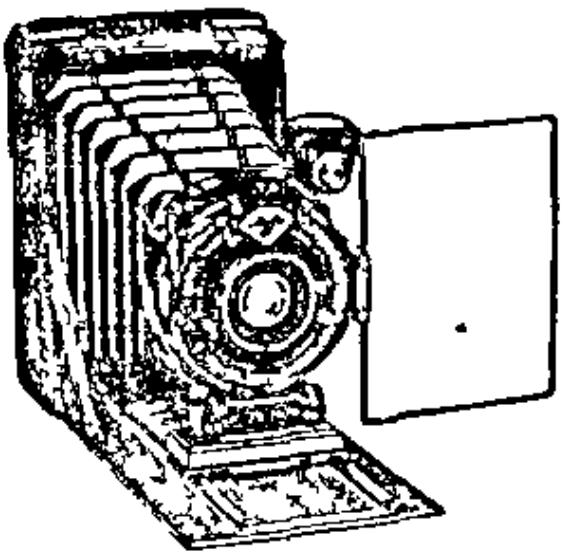

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